

Space Shuttle Flight Data File Preparation Standards

Appendix F of the Space Shuttle
Crew Procedures Management Plan

Mission Operations Directorate
Operations Division

Revision B
October 1994

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas



Flight Data File Preparation Standards

Revision B

October 1994

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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HOUSTON, TEXAS

Rev B

REFERENCE DATA**GENERIC, Rev D (May 17, 1993)****PCN-4 (Mar 24, 1994) Sheet 1 of 1**

List of Implemented Change Requests (482s):

REF-734	REF-738	MULTI-975
REF-735	REF-743	MULTI-986
REF-737	REF-745	

NOTE
For STS-65 and subsequent flights

Incorporate the following:

1. Make the following pen and ink changes on current pages 3-19 and 3-20, 3-35 and 3-36, 4-5 thru 4-8, 4-35 thru 4-38, 7-1 thru 7-8:
 Add the word 'TEMP' in front of each page number
 Add the designator 'OI-22' conspicuously on each page, except pages 7-1 thru 7-8 (approximately 1/4-inch letters in lower right corner, if feasible)
 Add '(P&I)' after/near each page code
2. Replace vii thru x
3. Replace 2-3 thru 2-8
4. Replace 3-1 thru 3-4, 3-9 and 3-10
 Replace 3-13 thru 3-18 with attached 3-13 thru 3-20 (prior to page redesignated as TEMP 3-19)
 Replace 3-21 thru 3-24
 After 3-24, add TEMP 3-23 and TEMP 3-24
 Replace 3-25 and 3-26
 After 3-34, add attached 3-35 and 3-36 (prior to page redesignated as TEMP 3-35)
5. Replace 4-3 and 4-4
 After new page 4-4, add attached 4-5 thru 4-8
 After new page 4-8, add TEMP 4-3 and TEMP 4-4 (prior to page redesignated as TEMP 4-5)
 Replace 4-13 thru 4-18
 After 4-18, add 4-18a and 4-18b
 Replace 4-19 thru 4-24
 After 4-34, add attached 4-35 thru 4-38 (prior to page redesignated as TEMP 4-35)
 Replace 4-39 and 4-40
6. After 6-4, add attached 7-1 thru 7-8 (prior to page redesignated as TEMP 7-1)

Prepared by: _____
 Book Manager

Approved by: _____
 Head, Orbit Procedures and Flight Data File Section Chief, Space Shuttle Flight Planning Branch

Encl: 70 pages

J48041GD4

File this PCN immediately behind the front cover as a permanent record

APPENDICES

Listed below are the appendices of the Crew Procedures Management Plan (CPMP; JSC-08969) that expand the guidelines and policies of the CPMP into system requirements, working agreements, and work techniques. The appendices are separately published documents and are distributed on an as-needed basis. The Space Shuttle Flight Planning Branch, Operations Division, is the office of primary responsibility (OPR) for the CPMP in its entirety. The OPR for each individual appendix is as listed.

<u>Appendix No.</u>	<u>Title</u>	<u>OPR</u>
A.	Flight Data File Definition (JSC-10682)	NASA/DO4
B.	Flight Data File Management Support Plan (JSC-12933; RSOC 86-0100)	RSOC
C.	Management of Classified Flight Data File (Obsolete)	
D.	Crew Procedures Change Processing (JSC-19207)	NASA/DO4
E.	Decal, Velcro, and Nomenclature Control Plan (JSC-20318)	NASA/DO4
F.	Flight Data File Preparation Standards (JSC-09958)	NASA/DO4
G.	FDF Design and Materials Handbook (JSC-19203; RSOC 86-0181)	NASA/DO4
H.	FDF Schedules and Source Data (JSC-24409)	NASA/DO4
I.	Flight Data File Production Plan (JSC-22061; RSOC 86-0099)	RSOC
J.	Portable Onboard Computer Management Plan (JSC-22448)	NASA/DO4
K.	Crew Scheduling Constraints (JSC-22359)	NASA/DO4
L.	Training Data File Management (JSC-24435)	NASA/DT4

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1.0 INTRODUCTION

The Flight Data File (FDF) is the total onboard complement of documentation and related aids available to the crew for flight execution. It consists of data prepared by different sections, branches, and divisions within the Mission Operations Directorate (MOD). This data is combined into an effective FDF through use of a single set of preparation standards. This document establishes FDF standards for the Space Shuttle Program.

The FDF Standards are illustrated with numerous examples and figures, which are considered accurate for the standard that applies. However, these examples and figures should not be taken out of context from the appropriate text. Efforts are made to ensure that these examples are in accord with the FDF standards, but as the standards are refined or modified, a specific example may appear to be in conflict. A figure, for example, that is used to illustrate the placement of change bars should not be used as a guide for text placement which is illustrated elsewhere. Always refer to the proper text and example (if one is given) for a specific standard.

1.1 SCOPE

All documents produced by MOD to be used onboard the shuttle spacecraft will be part of the FDF and will conform to these standards. Classified FDF articles will comply with this document, where applicable, but should also comply with the current edition of the NASA Physical Security Handbook, JSC Security Manual NHB 1620.3A, and Appendix C of the Crew Procedures Management Plan (CPMP) for marking/identifying classified publications. Drawings in the FDF should conform to the MOD drafting standards.

To ensure uniformity, payload agencies should also use these standards to develop their Payload FDF (PFDF) articles. To conserve resources and expedite publication, procedure source documents (Shuttle Flight Operations Manuals, Crew Systems Operating Procedures, etc.) and flight procedures handbooks developed by MOD also should comply with these standards.

Although the FDF contains decals, photos, and other specialized articles, these standards pertain primarily to the paper documents that form the major portion of the FDF and the computer software (electronic documents) that emulate the paper documents. This includes procedural checklists, timelines, anomaly evaluation and response instructions, and reference data. This document does not address unique FDF articles such as Earth maps, special photos, or star charts.

1.2 AUTHORITY

This document is Appendix F of the CPMP and is written under the authority vested in the MOD for definition, development, validation, and control of all crew procedures and flight plans for NASA manned missions, as specified by JSC-07700, vol. VIII, NSTS Operations, Appendix L, Crew Procedures Control Board.

1.3 STANDARDS USE, EXEMPTION, AND CHANGE

The FDF Preparation Standards contain both standards and guidelines. Three levels of significance are established and the applicable level is conveyed through the use of the specific helping verb in the directive:

<u>LEVEL</u>	<u>VERB</u>	<u>SIGNIFICANCE</u>	<u>WAIVER*/ACTION</u>
Hard Standard	“shall ...”	Critical to flight operations or crew/orbiter safety	Written; halt processing prior to signoff
Soft Standard	“will ...”	Must be followed for clarity, consistency, printability, readability, and/or usability	Verbal or written; halt processing prior to print request preparation
Guideline	“should ...”	Recommendation; may be modified if there is a compelling reason to do so	None; notify book manager or author to verify guidelines cannot be used

*Waivers granted by FDF Manager or his representative. Additional coordination may be required.

NOTE: Statements of fact that are related to the standards but are not part of the standard use common verbs (e.g., “are” and “is”).

Normally, a waiver is limited to a given document or to a specific print package (e.g., Basic milestone, page change notice, etc.), but a written Avoid Verbal Orders (AVO) from the Flight Data File Manager may provide a general waiver that will affect all FDF documents. Likewise, a waiver issued for a specific situation in a specific document should not be construed as permission for a standard deviation in a different document or a different situation. Each approved waiver is a standalone adjudication.

The approval on a JSC Form 482 does not necessarily convey approval for an FDF Preparation Standards deviation. Changes to FDF documents submitted on JSC Form 482 request forms should conform to FDF Preparation Standards. Form 482s that are not in conformance will be edited and appropriately documented by the responsible Book Manager to comply with the Appendix F Preparation Standards; otherwise, a specific waiver will be required to incorporate nonconforming data.

Suggested changes to the standards provided in this document may be submitted to the Flight Data File Manager for consideration. The Flight Data File Manager will present proposed changes affecting crew interface to the Astronaut Office to obtain a crew consensus prior to disposition. Implementation of changed standards will normally be done on a noninterference basis in a regularly scheduled publication.

1.4 CLASSIFIED, PERSONAL, PROPRIETARY, AND SENSITIVE INFORMATION

The FDF may include classified documents. These documents adhere both to FDF standards and to the security ground rules implemented by NASA and DOD. In case of conflict, the security requirements and procedures shall supersede the FDF standards. Contact the FDF office for information on classified document standards, ground rules, and security requirements and procedures.

Occasionally, it is necessary to include non-classified data in a crewmember's flight copy of the FDF which cannot be released to the general public. Examples are an individual crewmember's medical information, proprietary systems drawings, proprietary toxicity information, and sensitive radio frequencies. The page change notice (PCN) containing the actual data is given limited distribution as determined by the Payload Officer, Book Manager, and FDF Coordinator. The PCN cover sheet, LOEP and, if required, an updated Table of Contents are given the standard distribution to ensure the entire community has the correct version of the book. A note should be placed on the PCN cover sheet to indicate that the actual data for the PCN is proprietary and has been given limited distribution. The enclosures listed at the bottom of the PCN cover sheet (Encl:) should indicate the number of pages for both those receiving the data (limited distribution), and those not receiving the data. Also, a special symbol should be used on the LOEP to indicate which pages have limited distribution. (See section 2.1.6.)

It is possible for a PCN to contain both regular data and proprietary data. In this case, special attention should be given to the enclosures at the bottom of the PCN cover sheet, the LOEP, and the note supplying additional information.

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2.0 BOOK STRUCTURE

Flight documents consist of books, individual cue cards, ringed cards, flip books, and other formats as required to facilitate crew use. FDF documents are printed in two forms: bond and flight quality. The flight-quality copies are printed on flight-qualified materials. The actual flight documents are fabricated per CPMP Appendix G, FDF Design and Materials Handbook. Bond books contain duplicates of the flight-quality documents, printed on standard 8-1/2 by 11-inch paper. Both flight-quality and bond books will be punched for ring binding.

This section contains the FDF standards for size, image area, composition sequence, page codes, pagination, and overall document layout that take into account both flight-quality and bond books. Information on sim pack and errata pack formats is given in section 4. Standards for other printed media, such as cue cards, are given in section 5.

FDF books are published as milestone editions, with subsequent revisions (Revs) and page change notices (PCNs) as required. Publications shall be identified as follows:

<u>Milestone Edition</u>	<u>Revision (Rev)</u>	<u>Page Change Notice (PCN)</u>
Preliminary (PRE)	Sequential English Letter	Sequential Arabic Numbers
Basic (BAS)	A, B, C, ..., W (Published Book)	1, 2, 3, ...
Final (FIN)		
Generic (GEN)		
Examples: BAS; FIN 2; PRE B; GEN D,2		

Criteria for determining whether to publish a PCN or revision are given in section 4.3. When there are conflicting criteria, the FDF Manager shall direct the type of change package to be published.

The latest published masters (with all applicable PCNs incorporated) will be used for reprints when the document inventory is depleted.

FDF books shall have the following composition, in the order given, for printing:

1. Standard JSC cover – not flown (flight cover replaces standard cover) [fig. 2-1 (a)]
2. Signature page – not flown (fig. 2-2)
3. List of implemented change requests (LICRs)* – not flown (fig. 2-3)
4. Areas of technical responsibility* – not flown (fig. 2-3)
5. (Optional: general notes regarding use of the book – not flown) (fig. 2-4)
6. List of effective pages (LOEP)* – not flown (fig. 2-5)
7. Table of contents (TOC) – normally flown (fig. 2-8)
8. (Option: general use notes as the last page of the table of contents – flown)
9. Body of text – flown

*Not required for Preliminary editions

10. (Option: special item configuration information or mission note section – not flown)
11. Flight cover (inside back cover, flight-quality copies only) – flown [fig. 2-1 (b)]
12. Distribution list (outside back cover, bond copies only) – not flown (fig. 2-14)

2.1 FRONT MATTER

Front matter consists of those items that identify the book, give its applicability (i.e., flight, vehicle, etc.), provide authority for use, contain change implementation information, and allow for ease of use (see items 1 through 8 in section 2.0).

2.1.1 Cover

New covers (JSC standard and flight) shall be prepared in accordance with the standards outlined in this section for each milestone edition or revision of FDF books. Formal covers shall not be provided for PCNs, but a cover sheet will be prepared according to section 4.3.

The cover for ground users meets the requirements of the JSC Management Instruction 1512.1D, Standards of Publication Covers. A different cover is used on the actual flight books to allow quick identification by the crew. See figure 2-1 (b) for an example of a crewmember's flight-quality cover. The flight patch is used for flight-specific books. However, the STS patch is used for generic and flight-specific books when the crew patch is unavailable.

The cover of a standard FDF document contains the following:

1. Unique JSC document number (48000–48500 block series for FDF books, with flight-specific number added as a suffix). The specific number will be obtained by the FDF Office from the JSC Technical Library. If a nongeneric book is to support more than one flight, the number of the first flight will be used as the suffix.
2. Series name transfer (i.e., Space Shuttle Program Flight Data File)
3. Book title (includes applicability if book is not generic) (reference CPMP Appendix D for approved titles)
4. Parent organization of the Office of Primary Responsibility (OPR) (i.e., applicable directorate and division)
5. Milestone edition name (i.e., Preliminary, Basic, Final, or Generic)
6. Revision identification if applicable (e.g., Basic, Rev A; Generic, Rev A; etc.)
7. Publication date (within ± 5 days of the "to print" date)
8. NASA logo
9. Bar code

When coordinated with the FDF Manager beforehand, the cover may also contain mission-specific information regarding specific program, payloads, launch date, special use considerations, etc.

Space Shuttle Program

FLIGHT DATA FILE

Entry Checklist

Specific Mission and Flight Supplement Identifier (if any). 30-pt Helvetica Bold

STS-67 Flight Supplement

Area reserved for mission-specific information when required. 24-pt Helvetica Bold

**Mission Operations Directorate
Flight Design and Dynamics Division**

**Final, Rev A
May 10, 1994**

24-pt Helvetica Bold

Example of note

NOTE
For integrated use with ENTRY C/L
Revision D only

Area reserved for note to user when required

National Aeronautics and
Space Administration

Lyndon B. Johnson Space Center
Houston, Texas

NASA

Bar Code (24-pt)

JSC-48020-67

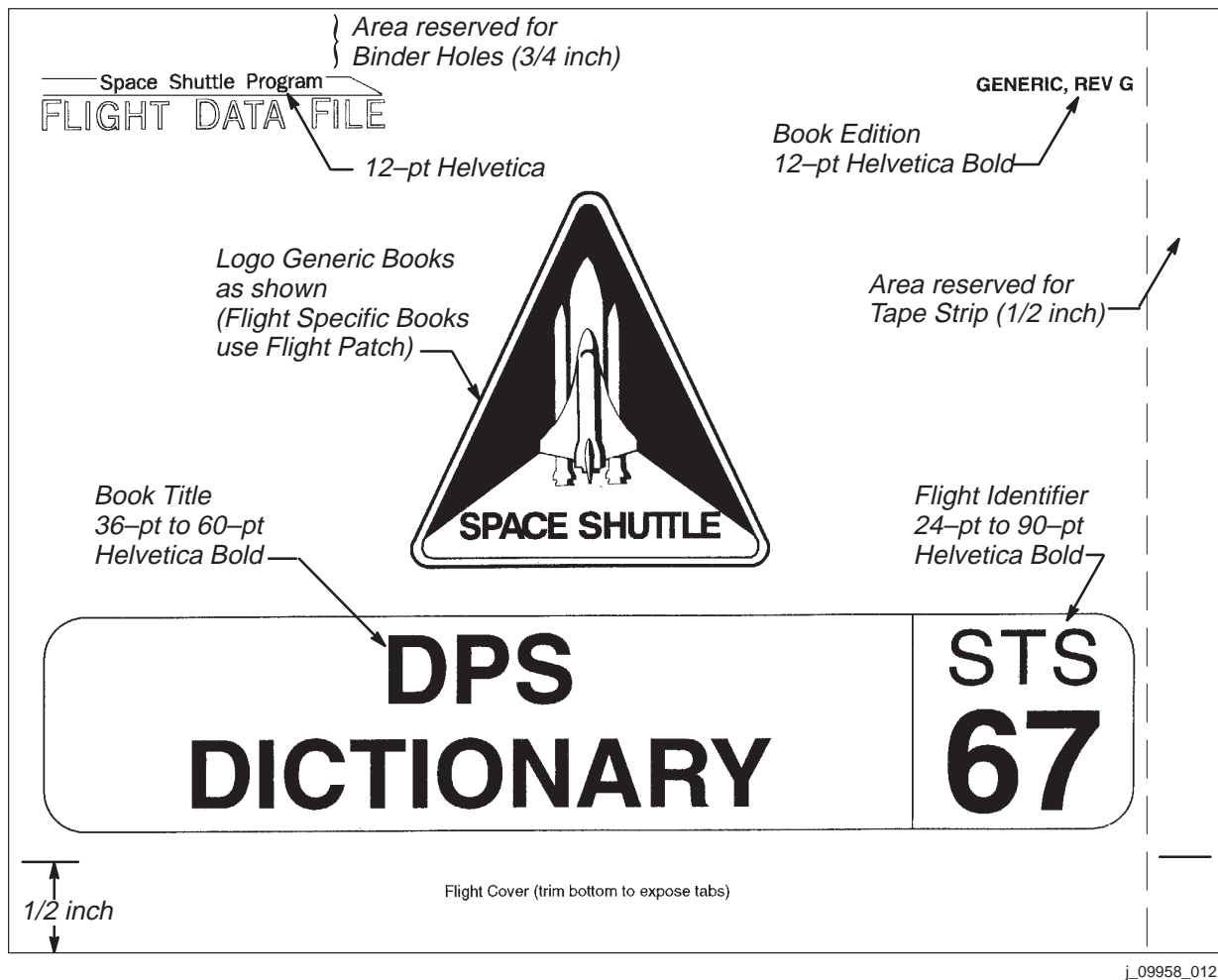
Series Transfer
JSC Document Number
12-pt Helvetica

Flight Number
12-pt Helvetica

Book Title
36-pt Helvetica Bold

(a) FDF standard book cover (reduced).

Figure 2-1.— Typical FDF book covers.



(b) FDF crew flight-quality book cover (reduced).

Figure 2-1.- Concluded.

On the cover, an area is also set aside to add a note to the users regarding effectivity or composition of the publication. Layout requirements, with the note affixed at an angle on the cover, are shown in figure 2-1.

Example:

<p style="text-align: center;">NOTE</p> <p style="text-align: center;">For STS-67 and subsequent flights</p>

A reprint uses the latest published cover with an added note stating that it is a reprint and listing all current applicable PCNs included in the reprint. If a user note already exists on the cover, the reprint note should be placed below and parallel (on an angle if the existing note is angled) to the existing note.

Example:

<p style="text-align: center;">REPRINT</p> <p style="text-align: center;">Generic, Rev B, reprinted March 31, 1995. Includes all updates thru PCN-8 dated February 26, 1995</p>
--

Bar codes shall be in the 3-of-9 format and shall provide the following information:

Leading “*”

Letter ‘J’ (JSC)

5-digit JSC document number

Milestone edition letter (P, B, F, or G for preliminary, basic, final, or generic respectively)

Revision letter or blank

One-digit PCN number (alphadecimal)[†] or blank

Two-digit flight identifier, if applicable

Trailing “*”

[†] The 1 thru 9 represents PCNs 1 through 9; A thru Z represents PCNs 10 through 35

Examples:

J48000F167	JSC #48000 (FLIGHT PLAN) Final edition, no revision, PCN-1, STS-67
J48036BA367	JSC #48036 (Orbit Ops Flt Supplement) Basic edition, Rev A, PCN-3, STS-67
J48035GF	JSC #48035 (Orbit Ops Checklist) Generic edition, Rev F, no PCN

Flight-quality covers will be printed on K-10 paper and bond covers will be printed on index stock. All covers will be white unless the document is flight specific. Flight-specific books, both flight-quality and bond copies, are provided with colored covers for easy identification of the applicable flight. The colors are given below for both regular flights and launch-on-need (LON) flights. (**NOTE:** The FDF Manager may designate colors for the covers of special FDF documents; i.e., covers of classified documents are pink.) Generic spacelab books, like other generic books, will have white covers. Flight-specific spacelab books (e.g., SL ACT/DEACT) will have the flight-colored cover.

<u>Flight program sequence designation</u> ⁽¹⁾	<u>Color</u>
STS-57,60,63,66, . . .	Blue
STS-58,61,64,67 . . .	Salmon
STS-59,62,65,68 . . .	Buff

(1) Examples: STS-66 is Blue; STS-67 is Salmon; STS-68 is Buff.

2.1.2 Signature Page

The signature page of FDF books (fig. 2-2) shall contain the following information:

1. JSC document number (including flight designator if applicable)
2. Full book title
3. Edition and date
4. Signature element of book manager
5. Signature element of approving authority (normally section head and branch chief; refer to CPMP Appendix D)
6. Statement regarding Crew Procedure Control Board (CPCB) control
7. Statement regarding change in distribution
8. Page code

The statement of CPCB control shall be one of those listed below as appropriate.

A statement for preliminary books that are not yet under control of the CPCB (i.e., do not require FDF Change Request Form 482s to change procedures) shall read as follows:

“This document is not currently under the configuration control of the Crew Procedures Control Board (CPCB). During the interim, changes may be submitted directly to the book manager.”

A book may be under partial control. An example of a book under partial control would be a preliminary deploy checklist whose upper stage procedures have flown before, but whose spacecraft procedures are new. In this case, the upper stage procedures would remain under control while the spacecraft procedures would not be under control. The statement for books under partial control shall be as follows:

“Parts of this document are under control of the Crew Procedures Control Board (CPCB). Consult the book manager for information on which procedures are under control. All proposed changes to controlled portions must be submitted on JSC Form 482 to DO4/FDF Manager. Changes to noncontrolled portions may be submitted directly to the book manager.”

JSC-48036-67

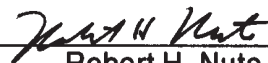
MISSION OPERATIONS DIRECTORATE

**ORBIT OPERATIONS CHECKLIST
STS-67 FLIGHT SUPPLEMENT**FINAL
December 2, 1994

PREPARED BY:

JoAnn Low
Book Manager

APPROVED BY:

Michael T. Hurt
Head, Orbit Procedures and
Flight Data File SectionRobert H. Nute
Chief, Space Shuttle
Flight Planning Branch

This document is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes must be submitted on JSC Form 482 to DO4/FDF Manager.

Additional distribution of this book for official use must be requested in writing to DO4/FDF Manager. The request must include justification and requester's name, organization, position, and phone number. Contractor requests are made through the NASA or DOD organization supported. Deletions, reduction in quantity, or change of address may be submitted to DO4/FDF distribution manager, (713) 244-1182.

ORB OPS/67/FIN

Figure 2-2.- Typical signature page of FDF book.

A statement may be required to indicate that the book may be changed by Discrepancy Notices (DNs) prior to and at the Flight Operations Review (FOR) as well as by 482s. A statement for books that are under control and are part of FOR data pack shall be as follows:

“This document is under the configuration control of the Crew Procedures Control Board (CPCB). Except for discrepancy notices (DN) approved at the flight operations review (FOR), all proposed changes must be submitted on JSC Form 482 to DO4/FDF Manager.”

A statement for books that are under complete control and require an approved 482 for all changes shall be as follows:

“This document is under the configuration control of the Crew Procedures Control Board (CPCB). All proposed changes must be submitted on JSC Form 482 to DO4/FDF Manager.”

The following statement will address distribution change requests:

“Additional distribution of this book for official use must be requested in writing to DO4/FDF Manager. The request must include justification and requester’s name, organization, position, and phone number. Contractor requests are made through the NASA or DOD organization supported. Deletions, reduction in quantity, or change of address may be submitted to DO4/FDF distribution manager, (713) 244-1182.”

2.1.3 List of Implemented Change Requests (LICR)

The back of the signature page will contain a list of implemented change requests (LICR) listing all Form 482 control numbers incorporated in the issue. The standard format will appear as shown in figure 2-3. If there are no change requests incorporated, one of the following legends will be used:

“NONE – Format changes”
 “NONE – Establishes baseline”
 “NONE – Not required”

Where applicable, the following special implementation note designators in parentheses shall follow the Form 482 number:

(P) – Partially implemented in this publication
 (R) – Remainder of a previous partial implementation is in this publication
 (S) – Requested change was superseded prior to implementation
 (D) – A previously implemented change is deleted by this publication

A change may be deleted because (1) it was approved as a temporary change or (2) it had received interim approval but was later disapproved.

An asterisk or other appropriate symbol next to the 482 number, and a statement such as “Previously implemented in an earlier publication” identifies a previously omitted 482 number. Whenever a special implementation note designator appears on the LICR (or PCN cover sheet), a footnote will define the designator. Using the appropriate definition as noted earlier, the footnote will follow immediately below the LICR frame (or 482 columns on PCN signoff pages). The footnote symbols should be used in the following order: *, †, ‡, Δ, \$. Do not use the pound (#) or the percent (%) symbols, which normally carry other meanings. See figure 2-3.

Incorporates the following:		
482#:	ORB OPS-123*	MULTI-765
	ORB OPS-124(R)†	MULTI-798(P)‡

* Previously implemented in an earlier publication
† Remainder of a previous partial implementation is in this publication
‡ Partially implemented in this publication

AREAS OF TECHNICAL RESPONSIBILITY

Book Manager	DO44/J. Jones	483-5555
COMM	DF2/D. White	483-5841
CDMS	DF2/R. Cook	483-5121
IPS	DF2/R. Cook	483-5121
ECLS	DF7/S. Clendon	483-4171

Figure 2-3.- LICR/areas of technical responsibility.

2.1.4 Areas of Technical Responsibility

A list of personnel and organizations who are responsible for specific portions of the book's technical content will be provided beneath the LICR. For uniform presentation, the first initial and last name of each individual will be used. The list includes the book manager and those people who work directly with the book manager on major areas such as systems; e.g., auxiliary power unit (APU), environmental control and life support (ECLS), or flight phases; e.g., rendezvous (RNDZ), payload deploy and retrieval system (PDRS) ops. The first entry under areas of technical responsibility shall be the book manager. The list will not include casual contributors. See figure 2-3.

2.1.5 Notes

Often, a series of notes are required to define the applicability of a book, time references used, any book-unique standards, or to give any other information needed to use a book.

If these notes are one or two pages long, they will be maintained on separate page(s) at the beginning of the book after the "areas of technical responsibility" and immediately before the LOEP. See figure 2-4 for a sample notes page. In this case, the page will not be tabbed and will be annotated as NOT FLOWN in the LOEP. If the notes will be longer than two pages or will contain graphic or tabular information, they will appear in a separate section at the end of the book. If the notes are added to the end of the book, each page will be marked NOT FLOWN and the LOEP annotated accordingly.

NOTES

1. The Wheels Stop/Egress Switch List, Section 7, gives the vehicle configuration at these discrete times. If switch position difference exists between wheels stop and crew egress, egress position will be boxed beside wheels stop position. Section 7 contains switch configuration only for panels that are reconfigured during crew execution of procedures in Sections 3, 4, and 5. Refer to DEORBIT PREP, Section 3, for egress configuration for remaining panels.
2. This checklist is an all-vehicle book and is not complete for a specified flight without a Flight Supplement. To obtain complete checklist, incorporate Flight Supplement for specific flight of interest using instructions in Flight Supplement List of Effective Pages.
3. Entry-related cue cards are contained in this document. Cue cards are listed in Entry Cue Cards Section. Some cue cards are printed in the body of checklist for MS use and also in the Entry Cue Cards section for reference of crop marks and fabrication instructions.
4. Velcro placement, size, and shape of cue cards are controlled by Cue Card Book Manager.
5. Vehicle configuration or procedural steps that are applicable to a specific vehicle are indicated by xxx.

v

ENT/ALL/GEN D

Figure 2-4.- Notes page.

2.1.6 List of Effective Pages (LOEP)

The LOEP serves as a guide for updating the book and verifying the correct configuration. It provides a record of the revisions and page changes for the latest milestone edition. The LOEP also contains information for fabrication of flight crew copies (e.g., pages requiring manually entered data or highlighting prior to flight, pages to be omitted from flight copies, pages added from other books, etc.). If applicable, the LOEP will include, following the listing of book pages, a list of fabricated items (cue cards, transparencies, etc.) documented in the book. Refer to figures 2–5 through 2–7.

The update history at the top of the first page of the LOEP will include the identification and publication date for:

- Current milestone edition
- Current revision, if any
- All page change notices, if any

Listed publications that are no longer applicable (i.e., all pages subsequently deleted or replaced) will be shaded to indicate that these issues may be discarded.

The body of the LOEP will contain

- The page number references for all pages – in the sequence they are published
 - “Sign Off” will be used in lieu of page i
 - Pages to be obtained from other sources will be included in the sequence in which they are to be inserted into the flight book
 - Pages deleted (not replaced) by the current update will be included
 - Pages deleted in previous updates will not be included unless a sequence is interrupted
 - Pages to be obtained from other sources or to be deleted may be grouped together in the list (e.g., 2–9 through 2–14 deleted)
- The current page code for each page – minus the book identifier part of the code
 - Pages to be obtained from other FDF books will identify the source. If the source is a companion-integrated book, “generic” or “flt suppl” will be used
 - Pages to be obtained from non-FDF documents will contain the page version identifier used in that document
 - Pages that are deleted will use “deleted” in place of the code
- Symbols or comments regarding fabrication of flight books
 - The symbols will be identified on the lower left corner of the page by footnote legends in 10-point type (except for the symbol). The standard fabrication symbols and legends will be as follows:

- * – Omit from flight book
- ** – Omit entire section from flight book (symbol placed next to first page in section)
- ⊗ – Highlights required
- Δ – (See note on page.) Flight books are to be treated differently per page footnote. See section 2.2.6. Commonly used for replacing a page in a generic book with a page from the flight supplement
- ☒ – Prelift-off information required
- † – Extra pages in crew copy only
- Other symbols (e.g., “‡” or “§”) may be used with appropriate footnotes to provide additional fabrication instructions. However, do not use the “#” or “%” symbols.

Duplicate pages (same page number) will not be listed in the LOEP nor be published as part of the book. If multiple copies of data on a page (normally fill-in forms) are required in the crew's book(s), the number of copies (e.g., “4 pgs”) will be inserted after the page number in the LOEP. The extra copies will be prepared separately. (If multiple copies of data on a page are needed by both ground users and the crew, each copy will be treated as a different page with different page numbers.)

Books consisting of a generic baseline with an integrated flight supplement will have a complete LOEP in each document. Each document will provide the codes for pages published in that document. The companion document will be identified as the source for pages to be inserted.

Whenever the complete LOEP is to be republished, a minimum of four blank lines will be reserved at the bottom of each column for use in future PCN publications and for pen-and-ink (P&I) notations. When the entire LOEP is not republished, the blank lines will be used to accommodate added page numbers and data.

For books containing fabricated items (e.g., cue cards, transparencies, etc.) and other special items (e.g., landing sites tape, Earth obs book, etc.), a fabricated items listing will be provided. If four or less fabricated items are included in the document, these may be placed on the last page of the LOEP, providing ample blank space (approximately four blank lines) is available to separate the data. However, the preferred method is to place the fabricated items listing on a separate page as the last page of the LOEP.

The “fab items” are listed by title (or other applicable identifier if there is no title) followed by the page number and the applicable code (see sections 5.5.1 and 5.7). When multiple copies of a cue card are required, the quantity is listed on the flight manifest. Multiple copy notations will not be added to the fabricated items listing nor will they be added to the cue card print masters. In integrated flight supplements the code for generic cue cards will be replaced with the legend “generic.” Likewise, the integrated generic book will use “flt suppl” for the code applicable to flight-specific cue cards. See figure 2-7 for an example of a fabricated items listing.

MEDICAL CHECKLIST			
LIST OF EFFECTIVE PAGES			
GENERIC		01/25/88	
REV B		08/30/93	
Sign Off	* ALL/GEN B	2-6	ALL/GEN B
ii	* ALL/GEN B	2-7	ALL/GEN B
iii	* ALL/GEN B	2-8	ALL/GEN B
iv	* ALL/GEN B	2-9	ALL/GEN B
v	* ALL/GEN B	2-10	ALL/GEN B
vi	* ALL/GEN B	2-11	ALL/GEN B
vii	* ALL/GEN B	2-12	ALL/GEN B
viii	* ALL/GEN B	2-13	ALL/GEN B
ix	* ALL/GEN B	2-14	ALL/GEN B
x	* ALL/GEN B	2-15	ALL/GEN B
1-1	ALL/GEN B	2-16	ALL/GEN B
1-2	ALL/GEN B	2-17	ALL/GEN B
1-3	ALL/GEN B	2-18	ALL/GEN B
1-4	ALL/GEN B	2-19	ALL/GEN B
1-5	ALL/GEN B	2-20	ALL/GEN B
1-6	ALL/GEN B	3-1	ALL/GEN B
1-7	ALL/GEN B	3-2	ALL/GEN B
1-8	ALL/GEN B	3-3	ALL/GEN B
1-9	ALL/GEN B	3-4	ALL/GEN B
1-10	ALL/GEN B	3-5	ALL/GEN B
1-11	ALL/GEN B	3-6	ALL/GEN B
1-12	ALL/GEN B	3-7	ALL/GEN B
1-13	ALL/GEN B	3-8	ALL/GEN B
1-14	ALL/GEN B	3-9	ALL/GEN B
1-15	ALL/GEN B	3-10	ALL/GEN B
1-16	ALL/GEN B	3-11	ALL/GEN B
1-17	ALL/GEN B	3-12	ALL/GEN B
1-18	ALL/GEN B	3-13	ALL/GEN B
2-1	ALL/GEN B	3-14	ALL/GEN B
2-2	ALL/GEN B	3-15	ALL/GEN B
2-3	ALL/GEN B	3-16	ALL/GEN B
2-4	ALL/GEN B	3-17	ALL/GEN B
2-5	ALL/GEN B	3-18	ALL/GEN B
* – Omit from flight book			
		iii	MED/ALL/GEN B

Figure 2-5.– Typical LOEP page of FDF book.

ENTRY CHECKLIST

LIST OF EFFECTIVE PAGES

GENERIC 02/08/94		PCN-1 12/12/94	
REV D	12/02/94	PCN-2	01/10/95
Sign Off	* ALL/GEN D	3-16	ALL/GEN D,2
ii	* ALL/GEN D	3-17	ALL/GEN D,2
iii	*Δ ALL/GEN D	3-18	ALL/GEN D
iv	*Δ ALL/GEN D	3-19	ALL/GEN D
v	* ALL/GEN D	3-20	ALL/GEN D
vi	* ALL/GEN D	3-21	ALL/GEN D
vii	* ALL/GEN D,2	3-22	ALL/GEN D,1
viii	* ALL/GEN D,2	3-23	ALL/GEN D
ix	* ALL/GEN D,2	3-24	ALL/GEN D,1
x	* ALL/GEN D	3-25	ALL/GEN D,1
xi	*Δ ALL/GEN D	3-26	ALL/GEN D,1
xii	*Δ ALL/GEN D	3-27	ALL/GEN D,1
xv	ALL/GEN D	3-28	ALL/GEN D
xvi	ALL/GEN D	3-29	Δ ALL/GEN D
1-1 (3 pgs) ...	† ALL/GEN D	3-30	Δ ALL/GEN D
1-2 (3 pgs) ...	† ALL/GEN D	3-31	ALL/GEN D
2-1	ALL/GEN D	3-32	ALL/GEN D
2-2 (6 pgs) ...	† ALL/GEN D	3-33	Δ ALL/GEN D
2-3 (6 pgs) ...	† ALL/GEN D	3-34	Δ ALL/GEN D
2-4	ALL/GEN D	3-35	ALL/GEN D
3-1	Δ ALL/GEN D	3-36	ALL/GEN D
3-2	Δ ALL/GEN D	3-37	ALL/GEN D
3-3	Δ ALL/GEN D	3-38	ALL/GEN D
3-4	Δ ALL/GEN D	3-39	ALL/GEN D
3-5	ALL/GEN D	3-40	ALL/GEN D,1
3-6	ALL/GEN D	3-41	ALL/GEN D
3-7	Δ ALL/GEN D	3-42	ALL/GEN D
3-8	Δ ALL/GEN D	3-43	ALL/GEN D
3-9	ALL/GEN D	3-44	ALL/GEN D
3-10	ALL/GEN D	4-1	ALL/GEN D
3-11	ALL/GEN D	4-2	ALL/GEN D
3-12	ALL/GEN D	4-3	ALL/GEN D
3-13	ALL/GEN D	4-4	ALL/GEN D
3-14	ALL/GEN D,1	4-5	ALL/GEN D
3-15	ALL/GEN D	4-6	ALL/GEN D

* — Omit from flight book

Δ — Replace with page from Flight Supplement

† — Extra pages in crew copy only

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ENT/ALL/GEN D,2

(a) LOEP for a generic book with an integrated flight supplement.

Figure 2-6.— Examples of LOEPs.

ENTRY CHECKLIST
STS-67 FLIGHT SUPPLEMENT

LIST OF EFFECTIVE PAGES

	FINAL PCN-1	12/02/94 12/15/94	
Sign Off	* generic	3-11	generic
ii	* generic	3-12	generic
Sign Off	* 67/FIN	3-13	generic
FS iv	* 67/FIN	3-14	generic
v	* generic	3-15	generic
vi	* generic	3-16	generic
vii	* generic	3-17	generic
viii	* generic	3-18	generic
ix	* generic	3-19	generic
x	* generic	3-20	generic
FS xi	* 67/FIN 1	3-21	generic
FS xii	* 67/FIN 1	3-22	generic
FS xiii	* 67/FIN 1	3-23	generic
FS xiv	* 67/FIN	3-24	generic
xv	generic	3-25	generic
xvi	generic	3-26	generic
1-1 (3 pgs)	† generic	3-27	generic
1-2 (3 pgs)	† generic	3-28	generic
2-1	generic	FS 3-29	67/FIN
2-2 (6 pgs)	† generic	FS 3-30	67/FIN
2-3 (6 pgs)	† generic	3-31	generic
2-4	generic	3-32	generic
FS 3-1	67/FIN	FS 3-33	67/FIN 1
FS 3-2	67/FIN 1	FS 3-34	67/FIN
FS 3-3	67/FIN	3-35	generic
FS 3-4	67/FIN	3-36	generic
3-5	generic	3-37	generic
3-6	generic	3-38	generic
FS 3-7	67/FIN	3-39	generic
FS 3-8	67/FIN	3-40	generic
3-9	generic	3-41	generic
3-10	generic	3-42	generic

* – Omit from flight book

† – Extra pages in crew copy only

FS xi

ENT/67/FIN 1

(b) LOEP for an integrated flight supplement.

Figure 2-6.– Continued.

SPACELAB PALLET SYSTEMS DATA BOOK

LIST OF EFFECTIVE PAGES

GENERIC 08/31/89		REV C 09/01/94	
PAGE/DWG§		PAGE/DWG§	
Sign Off	* GEN C	DWG 6.7 (1 of 4)	REV E
ii	* GEN C	DWG 6.7 (2 of 4)	REV E
iii	* GEN C	DWG 6.7 (3 of 4)	REV E
iv	* GEN C	DWG 6.7 (4 of 4)	REV E
v	GEN C	DWG 6.8 (1 of 2)	REV E
vi	GEN C	DWG 6.8 (2 of 2)	REV E
1-i	GEN C		
1-ii	GEN C		
Table 1-I	REV E		
2-i	GEN C		
2-ii	GEN C		
DWG 2.1	REV E		
DWG 2.3 (1 of 2)	REV E		
DWG 2.3 (2 of 2)	REV E		
DWG 2.6	REV E		
DWG 2.7	REV E		
3-i	GEN C		
3-ii	GEN C		
DWG 3.5	REV E		
4-i	GEN C		
4-ii	GEN C		
DWG 4.1	REV E		
DWG 4.2 (1 of 3)	REV E		
DWG 4.3	REV E		
6-i	GEN C		
6-ii	GEN C		
DWG 6.1	REV E		
DWG 6.2 (1 of 2)	REV E		
DWG 6.2 (2 of 2)	REV E		
DWG 6.3 (1 of 2)	REV E		
DWG 6.3 (2 of 2)	REV E		
DWG 6.4 (1 of 2)	REV E		
DWG 6.4 (2 of 2)	REV E		
DWG 6.5	REV E		
DWG 6.6 (1 of 4)	REV E		
DWG 6.6 (2 of 4)	REV E		
DWG 6.6 (3 of 4)	REV E		
DWG 6.6 (4 of 4)	REV E		

* — Omit from flight book

§ — Drawing codes from Spacelab Systems Handbook

iii

SLP SYS/GEN C

(c) Example of LOEP page for book containing drawings extracted from other sources.

Figure 2-6.— Concluded.

Figure 2-7.- Fabricated items listing.

2.1.7 Table of Contents

To aid the user in accessing the information contained within a book, all section titles that appear in the document are listed in the main Table of Contents (TOC). Section titles correspond to major tab titles, although tab titles may be abbreviated. Additional level of detail will vary, depending upon the nature of the book and the anticipated method of use. Refer to figure 2–8. A table of contents may appear at the beginning of each section, listing all subsection titles within that section. When this is done, the main TOC need not list all subsection titles.

For books such as the Ascent and the Entry Checklists, which are made of a continuous series of short, time-sequenced procedures and cue cards (as opposed to separate, individual procedures), the TOC lists only tabbed section titles. Individual procedures need not be listed since the crew does not work these procedures separately, but rather in a continuous sequence. The tabbed section titles are usually flight phases (e.g., OMS 2 BURN PROCEDURES). An exception is when individual procedures are Hazard Control (HC) procedures or are on the Critical Items List (CIL). In this case, the HC and CIL procedures shall be listed in the TOC so they can be annotated as such (refer to section 2.1.7.1).

Integrated supplemental sections or pages are noted as “FS” (flight specific) in the TOC page number column of the associated generic book. The supplement’s TOC lists both generic and supplemental pages.

The TOC for standalone generic books and corresponding nonintegrated supplements lists only the contents of the respective publication.

Alternate versions of a procedure have only one entry in the TOC, and the page number is listed without a version prefix (refer to section 2.2.4).

Repeated words or abbreviations are deleted in TOCs. Refer to the example shown in fig. 2–8 (e.g., CAB PRESS is not repeated for the CAB PRESS HIGH procedure title). This standard provides a visual point of debarkation and should be used for consistency. However, this standard may be waived where a loss of clarity could result.

2.1.7.1 HC and CIL Designation

Procedures designated as Hazard Control (HC) procedures shall appear with an “(HC)” after their titles in TOCs. Similarly, “(CIL)” shall follow procedure titles in TOCs for procedures on the Critical Item List (CIL) (see fig. 2–8). The “(HC)” and “(CIL)” identifiers shall not be removed from an existing FDF TOC without an approved Form 482.

<u>CONTENTS</u>	<u>PAGE</u>
MS POWERED FLIGHT	MS A-i
<u>APU/HYDRAULICS</u>	MS A1-1
APU SHUTDN	MS A1-2
SPD HI (✓CRT)	MS A1-2
OVERSPEED (>129%)	MS A1-2
UNDERSPEED	MS A1-2
OIL OVERTEMP	MS A1-2
HYD PRESS (LOW) (CIL)	MS A1-2
RSVR QTY (LOW)	MS A1-2
W/B QTY (LOW)	MS A1-2
<u>COMM/GNC</u>	MS A2-1
COMM LOST (MULTI PANELS)	MS A2-2
ICOM LOST	MS A2-2
FCS CH 1(2,3,4) (2nd FAIL)	MS A2-2
RHC L(R) (2nd FAIL)	MS A2-2
DISPLAY SW L(R)	MS A2-2
RM FAIL IMU,RGA,AA	MS A2-2
DLMA IMU	MS A2-2
<u>DPS</u>	MS A3-1
PASS GPC FAIL	MS A3-2
BFS GPC FAIL	MS A3-2
FF(FA) MDM OUTPUT	MS A3-2
PL MDM I/O ERROR	MS A3-2
PCM I/O ERROR	MS A3-2
SUMWORD ICC	MS A3-2
FA/FF MDM I/O ERROR	MS A3-3
PORT MODE	MS A3-3
BCE STRG X	MS A3-4
CRT LOST/DK XMTR	MS A3-4
DUAL CRT CMDRS	MS A3-4
BFS INADVERTENT DISENGAGE/	
UNSUCCESSFUL ENGAGE	MS A3-4
MULT DATA PATH LOSS (Non-Recov) (CIL) ...	MS A3-5
OPS 1/6/TAL TRANSITION RESTRING	MS A3-6
POST BFS ENGAGE	MS A3-6
<u>ECLS</u>	MS A4-1
CAB PRESS LEAK	MS A4-2
HIGH	MS A4-2
xiii	AESP/ALL/GEN

Figure 2-8.- Table of contents.

2.2 BODY OF TEXT

Each section's procedures or essential data shall begin on the back of a page with a major or minor tab. The front of a major tab-page will contain a section title, a section TOC, or nonprocedural supplementary material such as a schematic. The front of a minor tab-page will display the legend "This Page Intentionally Blank" or will contain the data for the end of the previous procedure.

2.2.1 Page Image Area

The image area for the body of the text is determined by several factors:

- Physical size of the page
- Allowance for print shop tolerances
- Allowance for punched holes
- Allowance for footer data (page note, number, code)
- Allowance for tab rows

The FLIGHT PLAN and selected other FDF documents shall be fabricated using 9 x 11 inch sheets for the tabbed pages. This allows for a larger page image area which is required so that real-time messages may easily be taped into the book. See figure 2-12.

Image area placement shall be the same for left and right pages (i.e., no dedicated left or right pages) because the masters are subject to reuse with different pagination requirements. Landscape pages will be oriented so that the page headers (top) on odd pages are near the bind side and the page footers (bottom) on even pages are near the bind side.

For both portrait and landscape pages, the maximum image areas, including space for footer data at the bottom and change bars at the right, are given in figures 2-9 through 2-12.

2.2.2 Font Style and Size Restrictions

The number of characters per line and the number of lines per page are not specified; however, 11-pt or larger Helvetica type shall be the standard used for text, with a written waiver (sec. 1.3) required for type smaller than Helvetica 9-pt (or the equivalent type size in other than Helvetica). Other font styles and sizes and the use of boldface (except for procedure titles) will be avoided. Boldface text often does not show up as such when photocopied. When boldface is used, it shall be the next point size larger than the surrounding text.

Exceptions to this standard are malfunction procedures, drawings, schematics, timelines, and pictorials which are Helvetica 8-pt, with a waiver required for type smaller than 8-pt. Also, the FLIGHT PLAN will use Helvetica 11-pt type text, but the FLIGHT PLAN timelines will use 8-pt type, with a waiver required for type smaller than 8-pt. The Orbit Pocket Checklist, Entry Pocket Checklist, Ascent Pocket Checklist, SLP DPS, SLM DPS, and DPS will use 10-pt type, with a waiver required for type smaller than 8-pt.

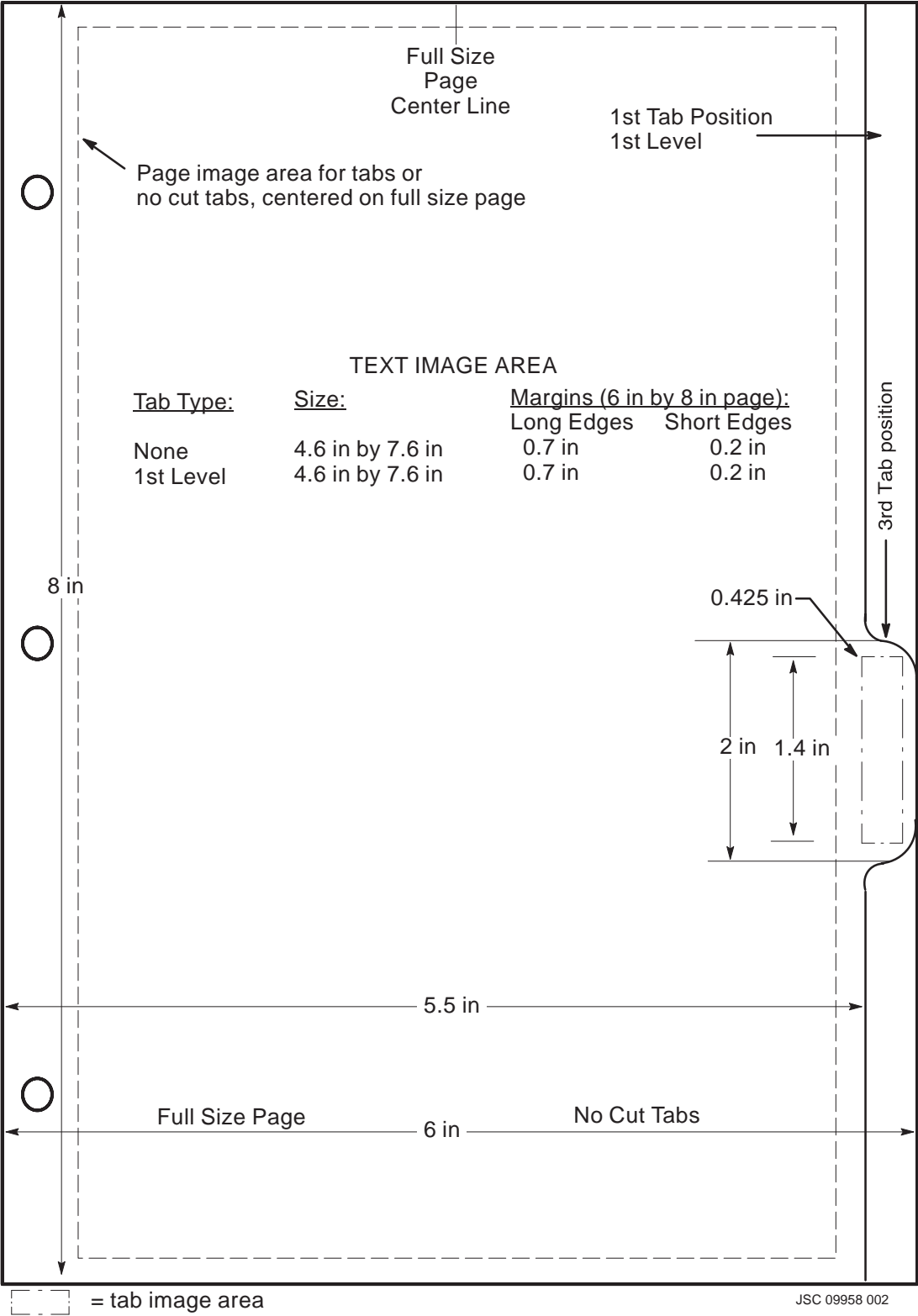


Figure 2-9.- Small book image areas using four 2-inch tab positions (illustration reduced; reverse side of the document page is mirror image).

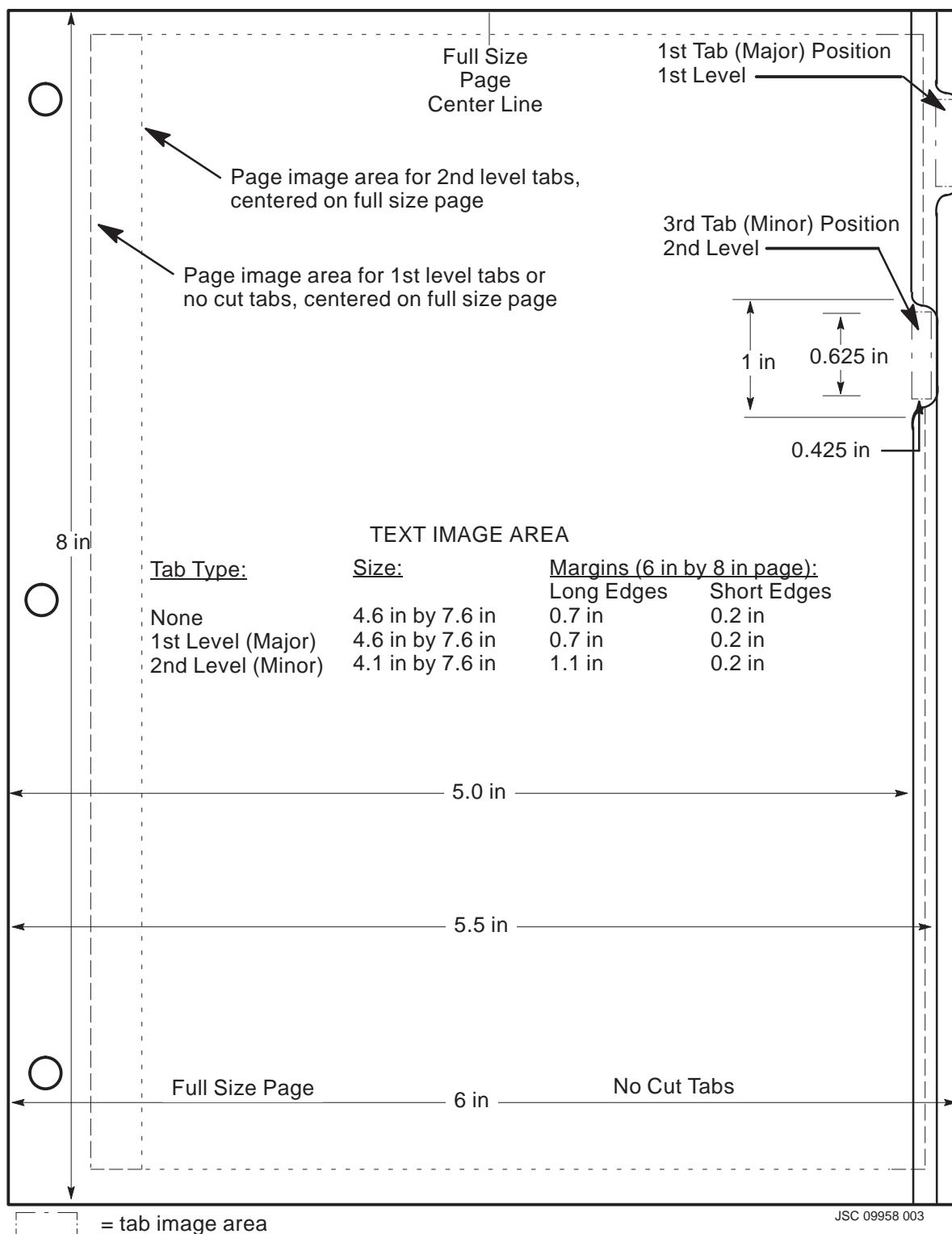


Figure 2-10.- Small book image areas using seven 1-inch tab positions (illustration reduced; reverse side of the document page is mirror image).

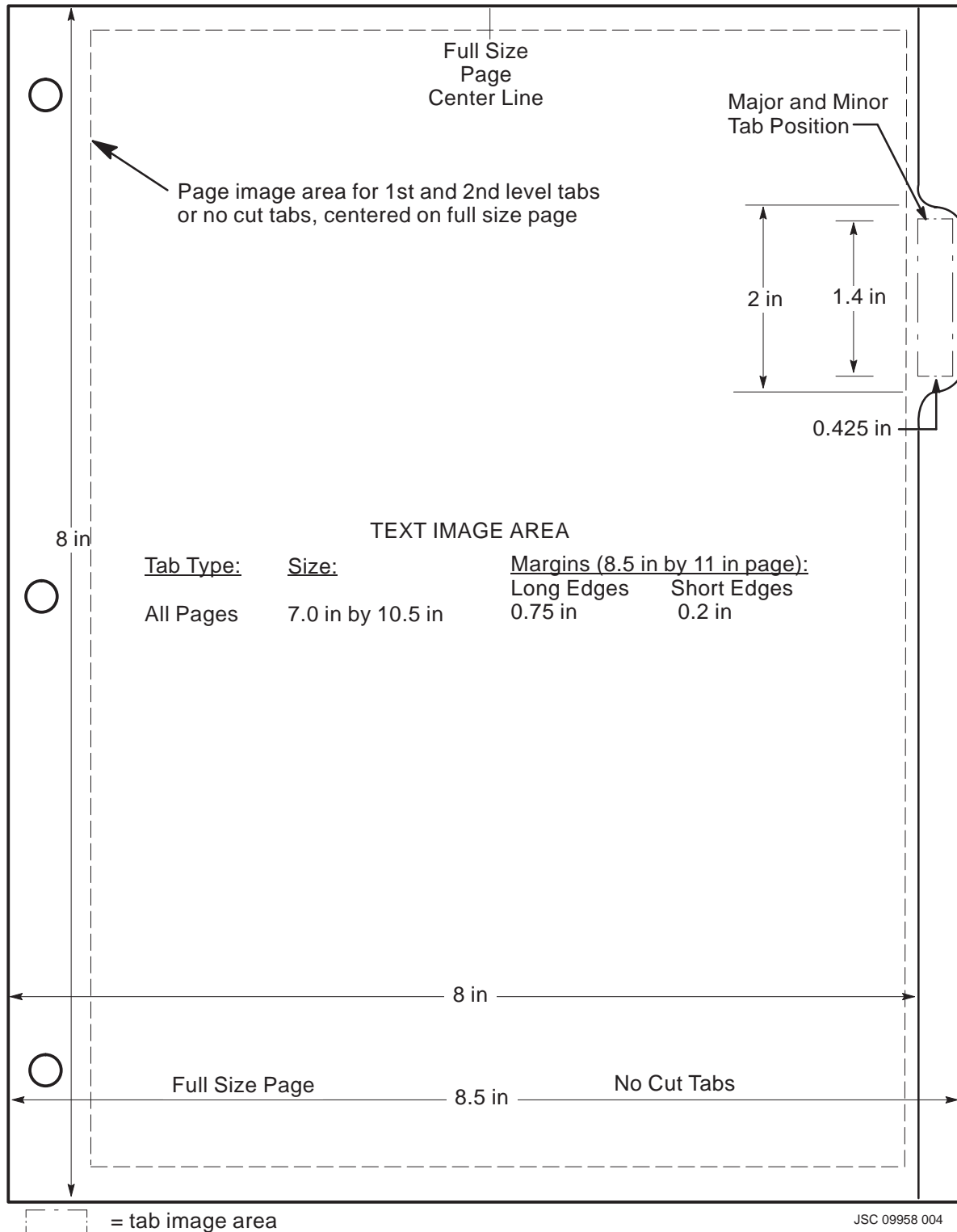


Figure 2-11.- Large book image areas using five 2-inch tab positions (illustration reduced; reverse side of the document page is mirror image).

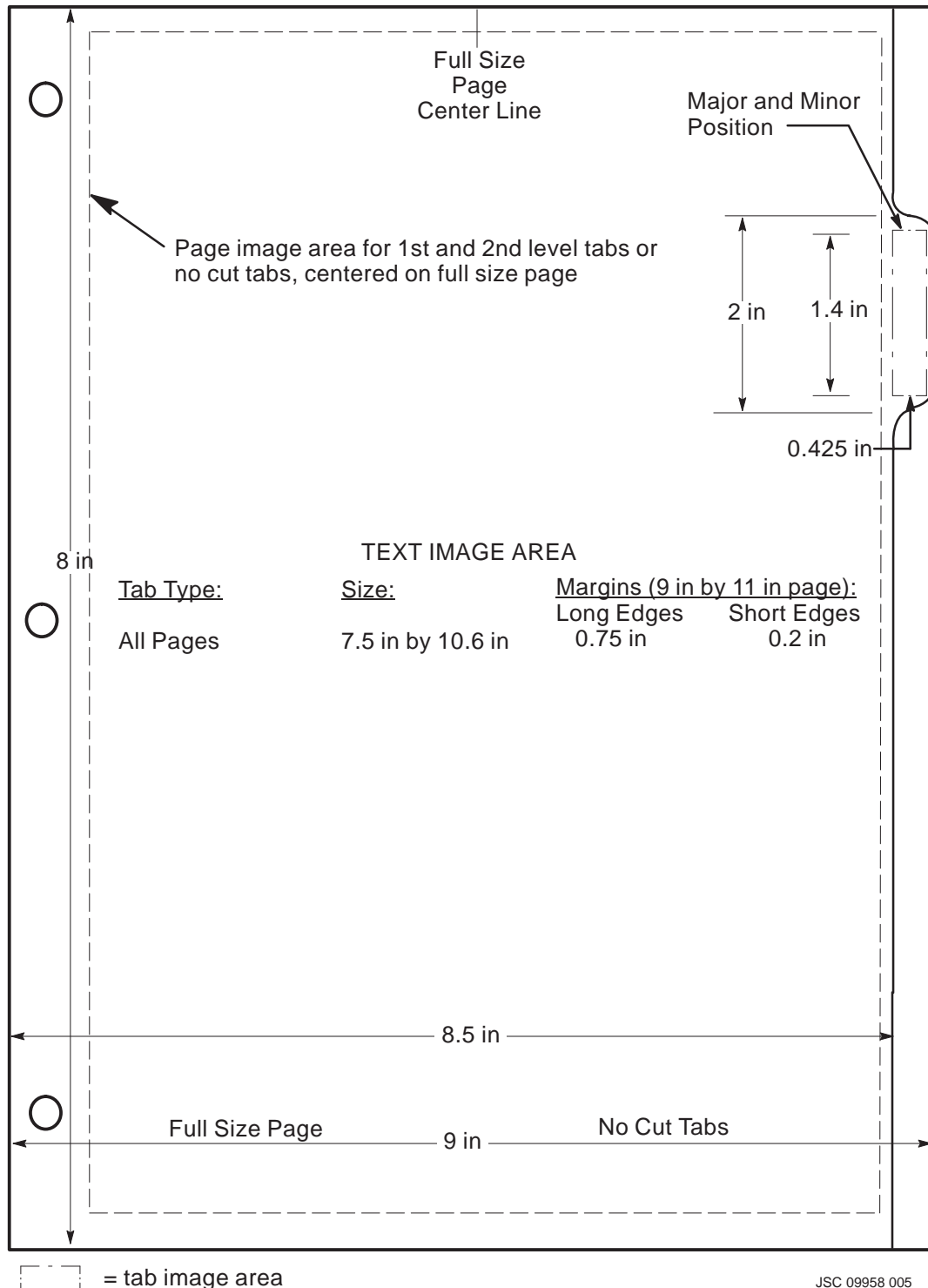


Figure 2-12.- FLIGHT PLAN image area using five 2-inch tab positions (illustration reduced; reverse side of the document page is mirror image).

2.2.3 Tabs and Paper Stock

Tabs are used to identify major book divisions (sections) and, when required, to give the crew quick access to standalone material. Tabs are not normally provided within book sections to separate material used in sequence or where page numbers from the Table of Contents are sufficient. Printed tabs shall be formatted for flight-quality books only and are thus not usable in the bond copies. However, as a result of using the same print masters for flight-quality books and bond copies, tab titles will appear on the bond copy pages.

Since tab space is limited, tab wording will be terse and short. Also, the length of text on tabs is significant because the tab must be cited when referencing data from book to book. Abbreviations are used as required. Each tab will have the same wording printed on both the front and back sides of the tab. (Flip book pages and pocket checklists are exceptions. See section 5.6.)

The following tabbing options are available:

- No tabs
- Individual sections identified by major tabs (flight color-coded for selected flight-specific books and flight supplements, green for generic books) with no minor tabs
- Individual sections identified by major tabs (flight color-coded for selected flight-specific books and flight supplements, green for generic books, yellow for contingency and time critical procedures) and some or all of the sections further subdivided (alphabetically, by system, etc.) by minor tabs (white)
- Individual sections identified by major tabs (yellow) and sections further subdivided by ladder tabs (pocket checklists only). (See section 5.2.1.1.)

When it is necessary to divide material within a tabbed section (major tabs) with additional sets of tabs (minor tabs), the two sets will be differentiated by:

- Level – first level for major tabs, second level for minor tabs
- Color – green or flight color for major tabs, white for minor tabs, yellow for contingency procedures

Full, uncut tabs (divider pages) may be used to group associated sections when required.

To keep the flight books uncluttered and also simplify their fabrication, cut tab sizes will not be mixed within a book. See figures 2–9 through 2–12 for examples of tab size and row configurations.

In nonintegrated flight supplements, major tabs and divider pages shall be color-coded to indicate the applicable flight (refer to section 2.1.1). Integrated documents should use white tabs in both the generic and the flight supplement units, with green divider pages if used.

Tabs will be 1/2-inch deep (image area of 0.425 inch) with two lines of Helvetica 12-pt Bold. The image-area tab length will be 1.4 inch or 0.625 inch for the large or small tabs, respectively. The lines of type shall run parallel to the “long” edge of the page, with the top of the wording up (landscape format) or to the user’s left (portrait format) on both the front and back of the tab. An exception will be the AESP flip book tabs, which use select lines of type that will run parallel to the “short” edge of the page. The two-line tabs will be centered within the tab image area.

The use of large tabs will allow either four or five tab positions for small and large books, respectively. Small tabs will allow seven positions in small format books. The tab sequence shall begin with the first position located as shown in figures 2-9 through 2-12.

Differentiation between major and minor tabs in the large checklist format shall be by “color only” unless there is a compelling reason to do otherwise. This means that primary (major) tabs and the subtabs (minor) will be at the same level, printed on the 8-1/2-inch or larger pages (i.e., 9-inch for the FLIGHT PLAN). The primary tabs will be on green paper for generic books (yellow for contingency procedures on primary tabbed pages) and flight color paper for the flight-specific books. The subtabs (minor) will be on white paper. Paper stock for bond distribution FDF documents shall be standard bond weight paper for all pages except the covers which are index stock. Flight-quality FDF documents shall be either K-10 card stock or reinforced bond (60-lb R-bond), depending upon page use.

For flight-quality documents, all tabbed (major) divider pages and covers shall use K-10 paper stock. Also K-10 paper stock shall be used for pages identified to be removed for flight use (i.e., tear-out pages). The non-tabbed pages and the minor tabbed pages shall use reinforced bond (60-lb R-bond). The following list of books shall use K-10 card stock for all nontabbed pages as well as for tabbed pages and covers:

Ascent Checklist – used with gloved hands

Entry Checklist – used with gloved hands

Ascent/Entry Systems Procedures – pages are flown in the front of the Ascent Pocket Checklist and the back of the Entry Pocket Checklist

All Pocket Checklists (except the powerdown sections in the Orbit Pocket Checklist which shall be on R-bond paper) – most of the Pocket Checklists have ladder tabs

FLIGHT PLAN – allows uplinked messages to be taped in the document

Post Insertion – gives “body” to a very slender book

In the placement of large checklist tabs on 8-1/2- by 11-inch pages or 9- by 11-inch pages, the following positions shall be used:

Major 1

Minor 2, 3, 4, 5, 1, 2, 3, etc.

Major 2

Minor 3, 4, 5, 1, 2, 3, 4, etc.

Major 3

Minor 4, 5, 1, 2, 3, 4, 5, etc.

Major 4

Minor 5, 1, 2, 3, 4, 5, 1, etc.

Major 5

Minor 1, 2, 3, 4, 5, 1, 2, etc.

In using this sequence for tab positions, the first minor tab after each major tab shall be placed in the successive position relative to the major tab. For example, the major tab for section 1 shall be in the first tab position. The first minor tab in section 1 shall follow the major tab and be placed in the second tab position. Likewise, the first minor tab in section 2 shall follow the major

tab (in tab position 2), which places the minor tab in tab position 3. Tabbed pages create extra work and cost in producing an FDF document. Therefore, tabs will be discouraged unless essential for real time use of the book. If tabs seem to be frivolous, the FDF Manager shall review their use with the appropriate users to determine if the tabs can be eliminated.

2.2.4 Pagination

All FDF document pages, including the signature page and intentionally blank pages, shall be assigned unique page numbers. Right-hand (front) page numbers shall be odd and left-hand (back) page numbers shall be even. Page numbers will be centered on the bottom line of each page. Refer to figure 2-13.

The back of the signature page and every page of front matter thereafter will have lower case sequential Roman numerals (beginning with ii; the signature page is understood to be i). Beginning with the first page of the text and continuing throughout the document, the remaining pages will be numbered in Arabic numerals that indicate the section number and page sequence within the section (e.g., 1-1, 2-1, 3-1, 4-1).

When additional pages must be inserted within the already established sequence of pages, new pages with lower case alphabetical suffixes shall be added. The letters "a," "c," "e," etc., shall be considered "odd page numbers" and shall appear on right-hand (front) pages (e.g., 2-7 and 2-8, 2-8a and 2-8b, 2-8c and 2-8d, and 2-9 and 2-10 shall be a front/back sequence beginning with 2-7 on a right-hand page).

When an entire additional section must be inserted within the already established sequence of sections or multiple sections serving the same purpose (e.g., for different payloads), a capital letter will be added after the section number. For example, if an additional section is required between existing sections 8 and 9, the page numbers for the new section are 8A-1, 8A-2, and 8A-3, etc.

Pages that document the content and/or configuration of material presented to the crew via special nonbook media (card stock, transparencies, video tapes, computer software, etc.) will be contained in a section titled "Configuration" or similar title (e.g., "Cue Card Config") with "CONFIG" or "CUE CARD CONFIG" on the tab. Each page in this section containing configuration material will use a "CC" prefix (e.g., CC 11-5, FS CC 12-2). Within the consolidated configuration section, blank pages, header pages, and nonconfiguration data pages will be presented without the "CC." Pages in the body of the flown book (as with the not-flown configuration section) containing configuration items (i.e., crop marks, Velcro placement) will have "CC" as a page number prefix.

Pages that are prepared for the crew in flip-book format (i.e., book with self-restraining pages) will use an "FB" prefix.

Pages in flight-specific supplements will use the letters "FS" preceding the page number (e.g., FS 1-2, FS 3-4, FS CC 5-6).

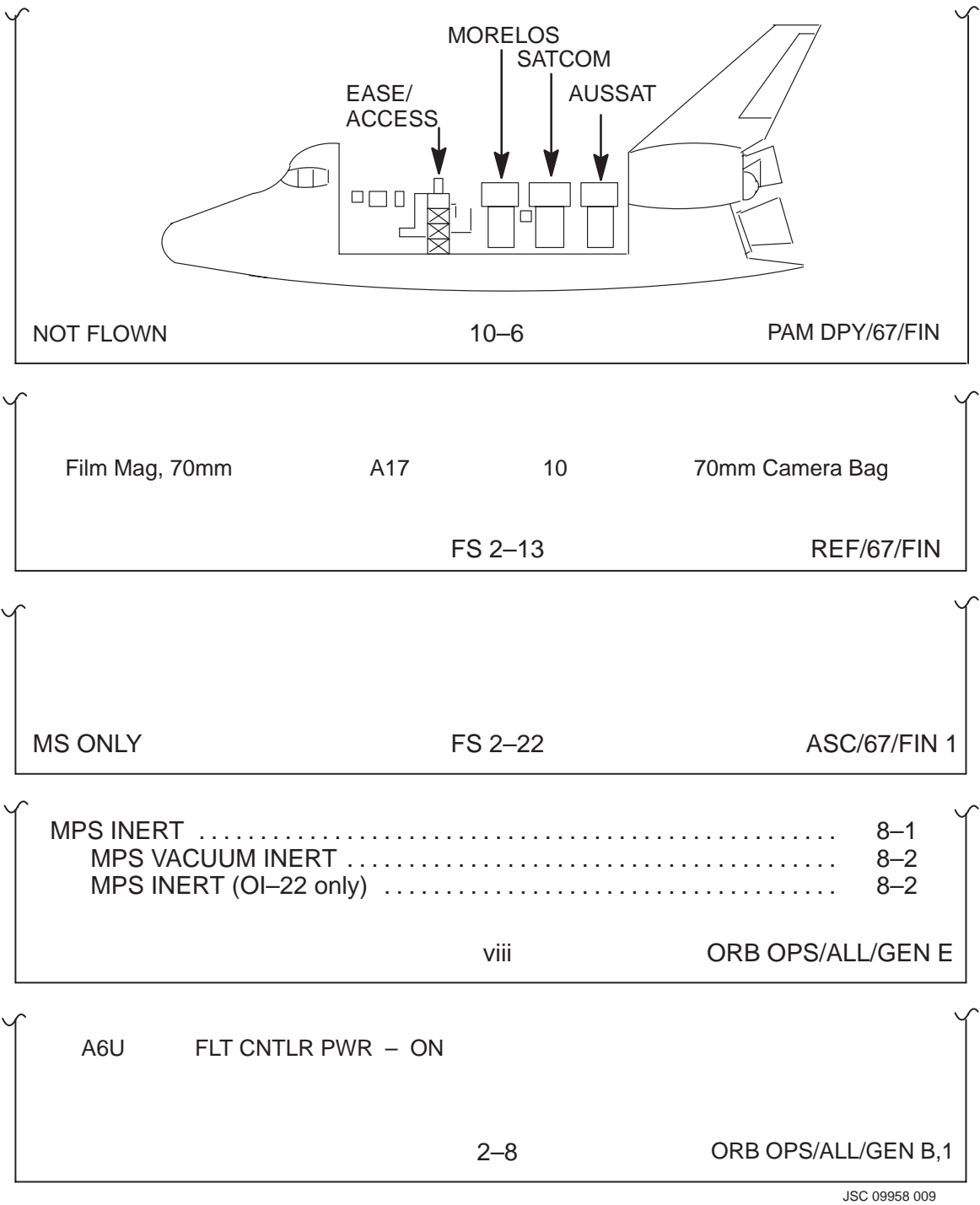


Figure 2-13.- Examples showing the position of page notes, page numbers, and page codes (at bottom of pages from selected small checklists).

The Ascent/Entry Systems Procedures (AESP) book contains sections that are inserted into other books. Pages in the AESP for insertion into the mission specialist (MS) copies of the flight-quality Ascent Pocket Checklist (ASC PKT) and Entry Pocket Checklist (ENT PKT) will have page codes preceded by “MS” (e.g., MS 8–5).

When multiple (alternate) versions of a page are required in an otherwise generic book (to support various flight configurations; only one version is flown on a given flight), a different upper case alphabetical prefix is placed immediately in front of the section number for each alternate page (e.g., A5–2, B5–2, CC A11–6). Both sides of an alternate page have the same prefix, even if the material on one side is generic. If one version requires more pages than the other(s) so that the multiple versions maintain the same page number reference in the TOC, lower case alphabetical suffixes are used (e.g., C6–8a, C6–8b) on the additional pages of the longer version, or “This Page Intentionally Blank” pages are inserted to adjust the page configuration.

On temporary pages, which are used in generic books to provide material that is changed or added for a single flight only, TEMP is added in front of the page number (e.g., TEMP 8–8, TEMP 12–5a, TEMP CC 13–7, etc.). Both sides of a temporary page have the same prefix, even if the material on one side remains generic. Temporary pages are added via a PCN which clearly states that the generic (old) pages must be retained for follow-on flights (refer to section 4.3).

Alternate and temporary pages shall have an applicability designator (e.g., OI–20, 67, SL, etc.) printed in large bold letters in the lower right-hand corner. This is to allow quick, easy identification during use. This applicability will be printed on both sides of a page, even if one side is “generic” since the page codes will reflect the proper applicability. This will make alternate/temporary pages as easy as possible to use. Pages will not carry both an alternate and a temporary designator (e.g., page 5–2 may be TEMP 5–2 or A5–2, but not TEMP A5–2).

Foldout drawings do not have page numbers if they are not printed as part of the book. The pages of the book they are in should be numbered as if the drawings were not in the book (e.g., 1–1, 1–2, ..., 2–1, 2–2, ... etc.) with the drawing inserted between pages as indicated in the LOEP. See figure 2–6 (c).

Blank pages within or at the end of text are numbered in the regular page sequence and identified with the notation “This Page Intentionally Blank.”

2.2.5 Page Codes

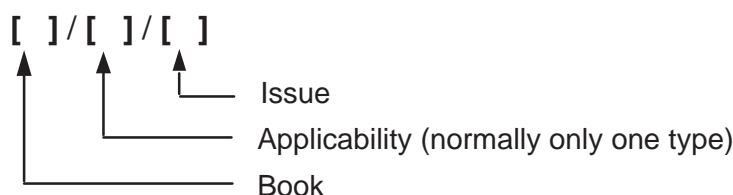
Each FDF page is identified with a code or other tracking data. Any change on a page, either technical or nontechnical, will require a revised page code. The typical FDF page code identifies the book, applicability, milestone edition (Preliminary (PRE), Basic (BAS), Final (FIN), or generic (GEN)) and latest change (revision and/or PCN). The code will appear at the lower right-hand corner of each page on the same line as the page number. Refer to figure 2–13.

Prepared material (including cue cards – refer to section 5.5) used directly in FDF books will retain any identifying data provided within the page image area of that material. The FDF page code, normally below the page image area, is used on the Page LOEP, while the identifying data is used on the Fabricated Items LOEP.

The most recent drawing number is used to track schematics. The drawing number will be used on the Page LOEP, with additional reference data and/or source page codes if required (see sec. 2.1.6).

Page codes shall contain the following identifiers:

1. Book – Abbreviation given in CPMP Appendix A
2. Applicability – Flight (NASA identifier or “ALL.” An “ALL” indicates all flights on which the book is manifested) or
 - Vehicle (last digit of assigned number; 2 = OV102) or
 - Payload (abbreviation as approved by the FDF Manager) or
 - Not used for generic spacelab documents that have either “Module” or “Pallet” included in the document title (e.g., SLM/SLP MAL books, SLM/SLP REF DATA books, and SLM/SLP SYS DATA books)
3. Issue – Milestone edition (PRE, BAS, FIN, or GEN), revision letter (A, B, C, etc.), and/or PCN number (1, 2, 3, etc.)



Examples of correct page codes:

SL IPS OPS/ALL/GEN B,1 – Spacelab Instrumentation Pointing System (IPS) Operations Checklist/generic material/published in the first PCN to the second revision of the generic edition.

ENT/67/FIN 3 – Entry Checklist Flight Supplement/contains material applicable to flight STS-67 only/published in the third PCN to the Final edition.

MAL/2,4/GEN – Malfunction Procedures book/contains material applicable to vehicles OV102 and OV104 (not OV103 or OV105)/published in the generic edition.

D/O/3+/GEN C – Deorbit Prep book/contains material applicable to vehicles OV103 and subsequent vehicles/published in the generic edition, third revision.

PL OPS/FEE/PRE – Payload Operations Checklist/material is valid for all French electrocardiograph experiment (FEE) missions regardless of the flight or vehicle/published in the preliminary edition.

Examples of incorrect page codes:

REF FS/3/67/FIN – Either the flight designator or the vehicle designator is not required (only one vehicle is assigned to a given flight). Also, the “FS” is not required.

IUS DPY/70/IUS/PRE – The payload designator is redundant (the book is dedicated to IUS deploy missions).

FLT PLN/71/BAS A,1,2 – The “1” will not appear in the issue identifier (PCN-2 is the last update).

CONT DEORB/STS – 70/Basic, Rev F, PCN 6 – Improper flight designator and abbreviations.

FLT PLN/58/FIN,1 – The comma will not be used unless a revision is indicated. This will appear corrected as FLT PLN/58/FIN 1.

2.2.6 Page Notes

FDF pages do not necessarily fly as collated in the printed book. Some pages fly in books other than the one in which they are printed, some only in selected onboard copies, some in a different media, and others do not fly at all. A brief note will be added as needed on such pages at the far left of the page number in the footer (bottom line). Refer to figure 2-13. These notes expedite fabrication of onboard copies and also alert the ground controllers to what materials are available to the crew. The page note will be the same type size as the page number.

Examples of page notes are:

- “CDR ONLY” – Page will be placed in the commander’s copy of the book but not in any other copies onboard
- “MS ONLY” – Page will be placed in the mission specialist’s copy of the respective checklist but not in the other onboard copies
- “FAB USE ONLY” – Page will show material located in the Fabricated Items section of a book as it is fabricated for the crew (e.g., cue card, CRT overlay, etc.). Also used on most flip book pages that are printed in the flight-quality document as a fabrication instruction. The page will be a “NOT FLOWN” page.
- “NOT FLOWN” – Material on the page will not be needed for flight operations and will not be in the crew’s copy (e.g., the Ascent Switch Configuration list in the Ascent Checklist)

2.3 DISTRIBUTION LIST

Bond copies of FDF books will have a distribution list printed on the outside face of the back cover (see fig. 2-14). When additional space is required, the overflow will be printed on a second back page. Reprints do not normally have a distribution list, although a special distribution list may be used when warranted. All flight-quality copies are hand-distributed and do not contain a distribution list.

The bond copy distribution list consists of a generic “core” plus a flight-specific “delta” (addition). The “core” lists users who require all of the books while the “delta” lists users who require only the specified book for a specified flight. On the distribution list itself, these are interleaved by the distribution list generator.

A note similar to the one below will appear on FDF distribution lists.

<hr/> * NOTE * * FOR CHANGES * * IN DISTRIBUTION * * OR ADDRESS CORRECTIONS * * CONTACT THE FDF MANAGEMENT * * OFFICE AT (713) 244-1182 * * OR MAIL TO * * DO46/DISTRIBUTION MANAGER, * * HELEN CANADA * <hr/>

Figure 2-14.— Distribution list.

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3.0 PROCEDURES STANDARDS

Crew procedures will be formatted to provide clear and concise instructions for the flight crew. The presentation of data shall remain consistent as the crew moves from one FDF article to the next. Procedures are presented in a variety of ways: in large and small checklists, on cue cards, on decals, and in uplink messages. Each method has unique limitations and variations and usually has different procedural requirements, but an overall similarity must be maintained.

In addition to this document, the following documents and references will be used in preparing procedures:

- All Vehicle D&C Procedural Nomenclature
- Space Transportation System and Associated Payloads: Glossary, Acronyms, and Abbreviations (NASA Reference Publication 1059 Revised)
- DPS Dictionary
- Spacelab DPS/CDMS Dictionary (Module and Pallet)
- Government Printing Office (GPO) Style Manual
- JSC Publication Manual
- Webster's Ninth New Collegiate Dictionary

3.1 TITLES AND SUBTITLES

Procedure titles shall be in boldface type, all capitals, and at least one point larger than the type used for the procedure text. The first level subtitles will be unbolded, in capitals, and underlined. (Refer to 3.3.5.2.6 for the underscore convention of use and other levels.) Abbreviations such as PREP (preparation), OPS (operations), etc., will be used to simplify titles. Refer to the current Space Transportation System and Associated Payloads: Glossary, Acronyms, and Abbreviations book, NASA Reference Publication 1059, and Addendum B to the FDF Preparation Standards of Abbreviations Used in Procedural Nomenclature.

3.1.1 Title Location and Form

Procedure titles will appear once at the beginning of the procedure. Titles will not be continued at the top of each page unless intervening data requires this duplication for clarity. However, should it be desired to indicate that a procedure continues on a following page, the legend "Cont next page" will be placed (centered or flush left) at the bottom of the applicable pages above the page-number footer.

The general form for a system procedure title shall be as follows:

OBJECT/SUBSYSTEM ACTION (CLARIFYING COMMENTS – optional)

FCS C/O

STD AUD PNL CONFIG (ASC,ENT)

The boldface title will align with the location (panel) column, if used. If location designators are not used, the boldface title aligns with the step number position. (See 3.3.5.2.6 for levels of procedure titles.)

3.2 BODY OF THE PROCEDURE

A fully developed procedure defining crew operations will be composed of a timetag, a crew designation, the location identification, a step number, and an operation as shown below and discussed in the subsequent paragraphs:

TIMETAG	CREWMEMBER	LOCATION	STEP	OPERATION
TIG-25	PLT	R2	1.	HYD MAIN PUMP PRESS 1 – NORM

The boldface title will align with the panel number when used; otherwise, the title will align with the step number designator or the initial word of the procedure.

A simple two-step procedure using all designators and having a title will appear as follows:

HYD RSVR QTY LOW

TIG-25	P	R2	1.	HYD CIRC PUMP – ON
		O6	2.	GPC PWR – 3

When timetags are not used, but a crew designator, location, and step number are used, the procedure will appear as follows:

HYD RSVR QTY LOW

P	R2	1.	HYD CIRC PUMP – ON
	O6	2.	GPC PWR – 3

When timetags and crew designators are eliminated from the preceding example, the procedure will appear as follows:

HYD RSVR QTY LOW

R2	1.	HYD CIRC PUMP – ON
O6	2.	GPC PWR – 3

Likewise, not all procedures are written with timetags, crew designators, or step numbers. When the procedures are simplified with panel designators and procedural steps only, the procedure will appear as follows:

HYD RSVR QTY LOW

R2	HYD CIRC PUMP – ON
O6	GPC PWR – 3

An alternate method for adding the panel designation as reference only in procedures that do not normally carry a column of panel designators will be to add the panel reference in parentheses after the switch callout. However, if the crew is expected to locate the panel first, do not use this method to write procedures. The following example illustrates this method:

HYD RSVR QTY LOW

1.	HYD CIRC PUMP – ON (R2)
2.	GPC PWR – 3

Finally, titled procedures without any designators will be written flush left under the title as follows:

HYD RSVR QTY LOW

Determine condition of HYD CIRC PUMP

HYD CIRC PUMP – ON

Record status on control sheet

3.2.1 Crew Designation

Crew designation is optional in a procedure but is intended to show which crewmember is to perform an action. This determination is normally related to crew training and can be either general or specific. Single-letter abbreviations should be used only when space does not allow use of the preferred abbreviation.

Specific designations will be used to indicate a particular crewmember as follows:

CDR – Commander (also C)

PLT – Pilot (also P)

EV1 – EVA crewmember 1 (also EV2, etc.)

IV1 – Intravehicular Activity (IVA) crewmember 1 (also IV2, etc.)

MS1 – Mission Specialist 1 (also MS2, etc.)

PS1 – Payload Specialist 1 (also PS2, etc.)

CM – Any Crewmember

MS – Any Mission Specialist

A – All crewmembers

B – Both (both Commander and Pilot)

This designation will be placed flush left in the column at the left side of the image area unless a timetag is used. Crew designations will not be placed within the body of a procedure.

In some procedures, crew callouts (CM, MS) do not refer to particular crewmembers but are used to divide a task between two or more crewmembers.

3.2.2 Location Identification

Location identification is used to specify the location of a particular operation. Identification may be specific, such as a panel or stowage locker number. Likewise, the location identification may be general, such as flight deck, middeck, or airlock. The current applicable All Vehicle D&C Procedural Nomenclature document (JSC-19409) shall be used for the appropriate panel location callouts.

Panel numbers shall always be shown in switch verification lists, bus loss actions, and powerdowns. They shall always be used for circuit breaker actions (see section 3.2.4.3). Exceptions are parts of the Ascent Checklist, flip books, and Pocket Checklists where, due to

size limitations and the nature of the procedure, circuit breaker panel callouts will not be used. When panels have placarded row identification, the row should be used as part of the location callout. For example: ML86B:A, where "ML86B" is the panel number and "A" is the row.

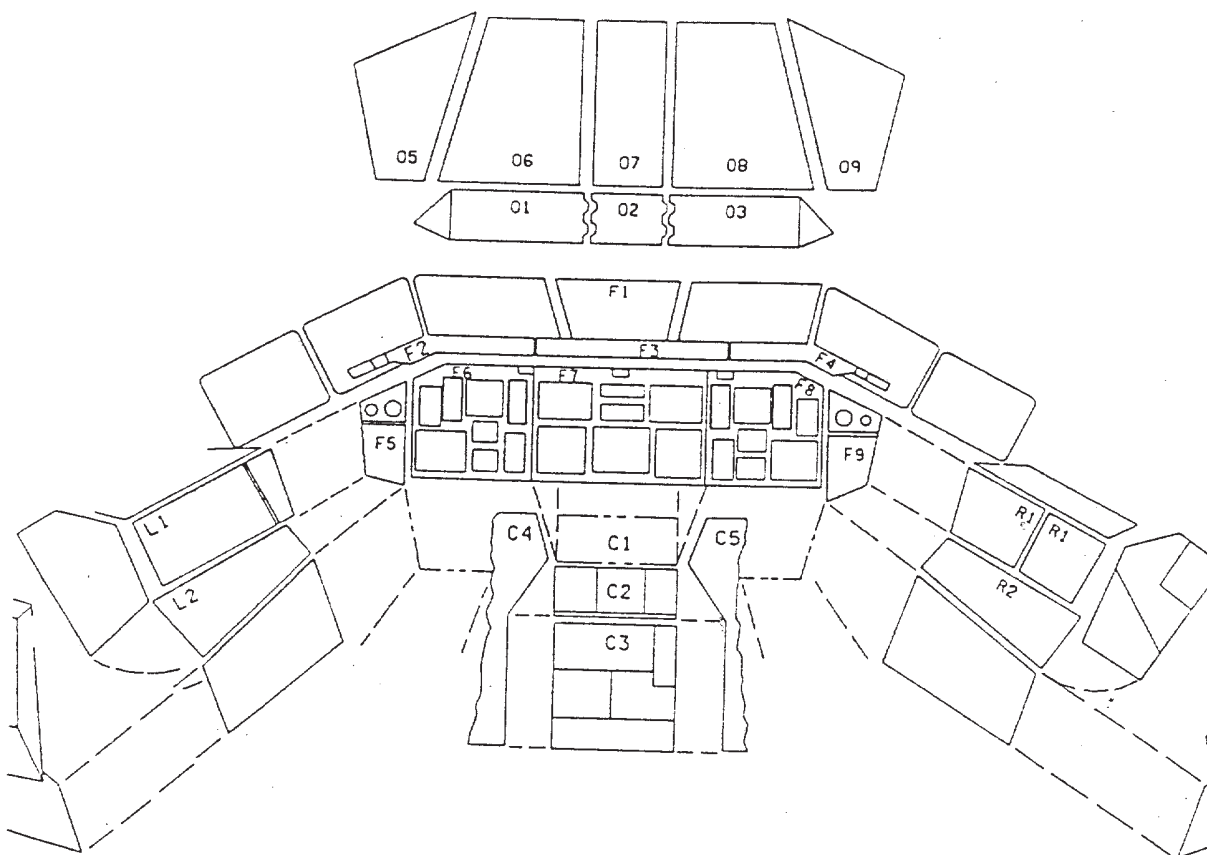
A location is usually specified for each step. However, in some cases this is not necessary because there is not a requirement to perform the operation in a particular location. For example, changing a portable timer battery may require going to a certain stowage locker for the replacement battery; therefore, the stowage location should be identified. However, when the act of replacing the battery is not restricted to a specific location, a location identification is not required for the replacement step.

Also, operations performed at the CDR and PLT stations do not require panel callouts. Figure 3-1 shows the panels where a location callout may be omitted. When performing deploy/recovery operations with the remote manipulator system (RMS), panel A8 may be assumed. Rotational hand controller (RHC), translation hand controller (THC), digital autopilot (DAP), cathode ray tube (CRT), and speedbrake/thrust control (SBTC) may also be assumed.

Do not call out CRT as a location for obvious CRT operations such as ops mode changes, item entries, or SPEC configuration changes unless confusion would result or unless a specific CRT (e.g., CRT 2) must be used.

In spacelab module books, which deal with module panels, orbiter panels can be distinguished from spacelab panels with callouts like "Orb R7."

Certain panels cannot be reached during ascent and entry, so the crew should not be directed to perform actions at these panels during the applicable times. Contact the Crew Systems Section, Systems Division, for the latest reach and visibility constraints.



JSC09958_013

NOTE: Switch configuration lists specify all panels.

Figure 3-1.— Flight station panels where location callouts are not mandatory (numbered panels only).

The location will be specified in a column to the left of the step number or between the crew designation column and the step number if both are used. For clarity, three–sixteenths (3/16) of an inch or more space is left between the location designation of the longest panel designator and the step number or the first character of the procedure. For example:

R12 1. FC PURGE VLVS (three) – GPC
ML86B:A cb MNA SPLY H2O TKA INLET – cl

Multiple panel locations are often combined to save space and to consolidate operations into single steps. For example:

To conserve vertical space use:

O14,O15,O16:F RJD DRIVER (eight) – ON

Or to conserve horizontal space use:

O14:F, RJD DRIVER (eight) – ON
O15:F,
O16:F

(The first example gives the preferred method.)

Alternate panel locations may be indicated in a manner similar to multiple panels, but the use of parentheses will indicate that the step is performed at EITHER one location OR the other. A slash indicates that the step is performed at one location AND/OR the other.

F6(F8) DATA BUS – 1

F7/A6U FLT CNTLR PWR – ON

In cases where the panel number is different in different vehicles, boxes will be used to indicate the various choices. An exception is in switch lists, where other standards may be used to conserve space.

103,104	F7	FLT CNTLR PWR – ON
102	F6	FLT CNTLR PWR – ON

3.2.3 Step Numbers

A step is a single discrete operation of a control device or other action. The task determines the criteria for establishing a step. As an example, the assembly of two hardware pieces (A and B) and their attachment to a vehicle window (C) may be described in one step:

1. Install A on B and B on C

However, two individual steps should be a better method of describing the task:

1. Install A on B
2. Install B on C

Step numbers should be provided for each action, except when closely related actions are to be executed. Steps will be numbered sequentially, with the number followed by a period.

In cases where line length is a problem, particularly in small checklist format, step numbers may be deleted. Where step numbers are deleted, blank lines will be used to provide the identification of grouped actions. Step numbers will be used for various reasons, such as when:

- Specific steps are called out in other procedures
- Execution spans a long time period
- Breaks are expected during execution
- Communication with MCC or other crew members regarding execution of procedures is expected.

Step numbers will be presented in a column and will be aligned on the period. An exception to this rule occurs when steps are indented to show conditional use as described in section 3.3.5.3 (Indentation).

For long procedures, alphabetic letters may be used to identify groups of steps followed by a new series of numeric step numbers. A procedure with more than 20 steps should be reviewed to determine if more than one independent activity is involved. If so, it may be more appropriate to divide a single procedure into two or more procedures. However, if all the steps are needed to complete a single activity, then look for obvious breaks in the steps. These breaks (or sub-procedures) can be labeled with a letter designator (A, B, C, etc.). This is especially appropriate when the steps are not contiguous (i.e., where there may be unassociated intervening activity).

In some cases, sub-procedures may be used to avoid continuing a set of steps based on a given condition across several pages. For example, instead of stating "If System A:" followed by 20 steps followed by "If System B:" with another 20 steps, an alternate expression could state: "C. If not System A, go to subproc D; otherwise:" for the procedure division.

The following example illustrates the use of alphabetic letters to create breaks (or sub-procedures).

MPS VACUUM INERT

A. ACTIVATION

After MPS dump complete:

1. Wait 5 min
2. MPS PNEU He ISOL – OP
- If LO2 MANF P < 30:
3. MPS FILL/DRAIN LO2 OUTBD – OP
4. INBD – OP

~

If MPS dump continues:

16. ✓MCC
17. MPS FILL/DRAIN LH2 OUTBD – OP
- INBD – OP
18. After 5 min or on MCC call, continue

B. TERMINATION

1. MPS FILL/DRAIN LO2,LH2 OUTBD (two) – CL, wait
10 sec, then:
2. MPS FILL/DRAIN LO2,LH2 INBD (two) – GND
3. PNEU He ISOL – GPC

Likewise, separate sections should be created for natural grouping when there are procedures to allow for efficient use of tabs. If there are no natural groupings, then artificial groupings may be appropriate. For example, a large number of DSOs can be grouped by DSO numbers such as “Section 5, DTO 111–154:” and “Section 6, DTO 167–203.” However, do not oversectionalize. Too many sections (tabs) are counterproductive because the tabs are too close together to be needed and excess tabs cause extra work in printing and fabrication.

A group of closely related actions will be given a single number. For example, step 5, below:

- | | | | |
|-------|----|-------------------|--------------|
| ML31C | 5. | WASTE H2O TK1 VLV | – CL (tb–CL) |
| | | DUMP ISOL VLV | – OP (tb–OP) |
| | | VLV | – OP (tb–OP) |
| MF57M | 6. | Unstow Gray Tape | |

Sometimes, a procedure may be divided into major blocks with the subtitles of the major blocks underlined in all caps. In these cases, the major blocks may be either numbered or unnumbered. For example:

OPTION 1:

1. COLLECT STAR DATA
(procedure steps as required)
2. VERIFY STAR DATA
(procedure steps as required)

OPTION 2:

COLLECT STAR DATA

1. *(procedure step as required)*
2. *(procedure step)*

VERIFY STAR DATA

1. *(procedure step as required)*
2. *(procedure step)*

A group of actions performed by one crewmember on one panel should be given a single step number. For example:

8. (Aff) cb AC CONTR (three) – cl
INV/AC BUS – OFF (tb–OFF)
INV/PWR – OFF (tb–OFF)
cb AC CONTR (three) – op

Note/Caution/Warning statements (see section 3.3.2) will not be numbered.

Conditional statements will not be numbered unless an action is included on the same line.

Steps numbers will be placed to the left of the procedure with a minimum of 3/16 of an inch separating the step number period and the first character (excluding a checkmark) of the procedural step itself. Part of the additional space will be reserved for the checkmark (✓) when required.

3.2.4 Operations

Operations will be expressed in either of two main forms: as an operational callout or as a “clear text” command. In both cases, the articles “a,” “an,” and “the” will be omitted for brevity, unless the article affects the meaning of the command. Also, the conjunction “and” will be replaced by a comma. See section 3.3.5.2.3.

The preferred method of expressing an operation, the operational callout, is used primarily to describe functions that are associated with displays and controls. The operational callout will be expressed by identifying the object(s) to be operated or observed followed by the action(s) to be performed. The object(s) and the action(s) will be separated by an open hyphen:

OBJECT – ACTION

For example, the callout to set the RIGHT AUDIO POWER switch to the OFF position is written:

R AUD PWR – OFF

To facilitate reading of several consecutive actions, the hyphens should be vertically aligned to the right of the object callouts. The hyphen may end a line, in a line break, but will not begin a line that requires a carryover of text to two or more lines. (See step 5 of the grouped actions example in section 3.2.3.)

When the “action” consists of a number (such as when a CRT field or indicator is being verified), a colon should replace the hyphen to avoid confusing the hyphen with a minus sign:

✓FREON EVAP OUT TEMP ind: 62 ± 2

However, the colon will not replace a hyphen specified in the D&C Procedural Nomenclature for panel callouts.

See section 3.3.4 for a discussion of the verification symbol (✓).

A command will be used primarily for operations not associated with displays and controls. Commands may be of two types: a “simple” command or a “conditional” command. Commands are generally written in clear text.

A “simple” command will use phrase structure beginning with a verb. For example, installing film into a camera:

Insert film into camera

A “conditional” command will also reflect basic phrase structure. However, the command will be preceded by a conditional clause introduced by a conjunction such as “if” or “when.” For example, for the crew to advance film after finishing an exposure:

When exposure complete, advance film

Simplicity will be the key to making a procedure easy to read and understand. Likewise, simplicity will conserve space, which is especially significant in the small-page format of certain books. However, some discretion should be used. Complex commands will be broken into multiple simple commands to improve clarity and readability.

Routine operations should be expressed as simply as possible. In describing the operation of a Calfax fastener, which in clear text would read:

Push knob in and rotate it counterclockwise 10 times

Use:

Loosen Calfax

Another way to maintain simplicity in operations will be to avoid using several words or sentences to describe a simple operation. For example, instead of:

Unlock and open stowage container lid
Remove hardware from stowage container and temp stow

Use:

Unstow hardware

Common sense should be used when making repeated references to a given item. For example, the crewmember may be instructed to obtain a 5-foot cable. The first time the cable is identified, it is called out as a "5-ft cable." Later in the procedure, if the identification is obvious and easily understood (i.e., only one cable was obtained), the operations should simply specify "cable."

Sometimes a procedure contains operations that deal with assemblies or subassemblies of hardware not covered by standard nomenclature documents. To further complicate the matter, some of these items have lengthy and wordy names that would have to be repeated throughout a procedure. In such instances, improved clarity is achieved by abbreviating the name, using any of several approved techniques.

The preferred technique to shorten a procedure will be to use accepted abbreviations. Another way will be to use the most descriptive part in the name. For example, consider an experiment hardware subassembly referred to as the "rear backplate/shelf assembly." To begin with, "assembly" should be abbreviated to "assy." The word "rear" may have no special significance; i.e., no other backplate/shelf assembly exists, then it would be advisable to delete "rear." Going a step further, if "backplate" for some particular reason has more meaning than "shelf," then it would be appropriate to delete "shelf." Consequently, the "rear backplate/shelf assembly" should be referred to as the "backplate assy." Also, if the "backplate assy" cannot be disassembled by the crew, the item should be further shortened to "backplate."

3.2.4.1 Switches

The standard for describing switch operations will use the following format:

SWITCH TITLE (quantity) – POSITION/ACTION (optional comments)

For example:

FLT CNTLR PWR (two) – ON
L,R OMS XFEED (four) – CL (tb-CL)
VTR pb – PLAY,RCD (simo)

The type of control device will be identified by using lowercase letters after the title for the following:

Pushbuttons – pb

Thumbwheels – tw

Display select switches – sel

The singular form will always be used regardless of the number of switches or control devices called out in the statement. Exception: The All Vehicle D&C Procedural Nomenclature document designates certain switches in the plural form, which shall be followed in those instances. Therefore, if more than one switch is involved, the quantity will be shown in lower case letters (never numerals) within parenthesis. (See section 3.2.4.8 for simplifying multiple switch actions.) For example, if all hydraulic circulation pumps are to be turned on, use:

HYD CIRC PUMP (three) – ON

When a switch is to be cycled or moved to multiple positions successively, the positions will be called out, separated by commas with nonplacarded positions or instructions also separated by commas. For example:

GPC MODE 1 – STBY,HALT,pause,STBY,RUN

The switch position or action shall be the placarded switch position (i.e., ON, OFF, A, PRI, etc.) given in the All Vehicle D&C Procedural Nomenclature document. See Appendix B for selected abbreviations used in procedural nomenclature.

Pushbutton actions should be described simply as “push.” Care, however, should be used in describing pushbuttons since it is difficult to explain exactly what switch state is desired. For example, during a lamp test, it may be clearer to use the following:

LDG GEAR ARM pb – It off

instead of:

LDG GEAR ARM pb – push
LDG GEAR ARM pb – ARM

Momentary (spring-loaded) switches may require an action of “push and hold” and the hold duration will be specified in parentheses. For example:

MOTION PRI – LOWER (hold 5 sec)

If a toggle switch has no placarded position, the words “up,” “dn,” “left,” “right,” or “ctr” will be used to denote the desired switch action. Direction will be relative to the placarded panel nomenclature and will be followed by a parenthetical statement of the function selected. As an example, “up (enable)” denotes that an up position enables the function.

Clarifying comments if needed, will be added in parentheses as a catchall, but will only serve to clarify the action and will not provide data found elsewhere in the procedure or notes.

For example:

A7U PL BAY FLOOD FWD,AFT (four) – ON (~3 min to full bright)

3.2.4.2 Valves

The standard for describing valve operations is as follows:

VALVE TITLE vlv (quantity) – POSITION/ACTION (optional comments)

For example:

CAB TEMP CNTLR vlv – FULL COOL

The lowercase “vlv” denotes that these are manually operated valves rather than switches. For valves that are operated by switches, “vlv” is not used. The same rules for showing the quantity of switches operated will apply to valves.

3.2.4.3 Circuit Breakers

Two types of circuit breakers are used in a spacecraft: toggle and push/pull devices. The standard for describing operations will be as follows:

cb TITLE (quantity) – POSITION/ACTION (optional comment)

For example:

O14:E cb ADTA 1 (two) – op
O13:D,B ESS 1BC CRYO QTY O2 TK2 (two) – op
L4:R AC1 Φ A INST R – cl

The lowercase letters “cb” shall always precede a circuit breaker operation callout. The panel and row will be identified (see section 3.2.2). The action will be open (op) or closed (cl) and will be written in lowercase letters. (For spacelab panels, one may encounter such nomenclature as “in,” “off,” and perhaps other cb positions.) In plain text, the circuit breaker will be either “cb” for singular or “cbs” for plural in lowercase letters. However, in panel callouts, the word “cb” will be used for both singular and plural usage.

Toggle breakers without placarded positions have also been used in spacecraft and will require an additional clarifying comment.

For example:

– cl (up)
– op (dn)

3.2.4.4 Meters and Indicators

The standard operation format for meters and indicators shall be as follows:

TITLE type (quantity) – READING (optional comment)

Meters and indicators are one of the following types:

meter indications – ind (tape, bar, digital, rotational)

lights – lt

flags – flag

talkbacks – tb

The reading of a meter will be shown without the units (i.e., psi, °F, etc.) unless necessary to avoid confusion. If an acceptable operating range has been determined, an approximate (~) reading may be used. Sometimes colored tape is used on the panel to make a range clear to the crewmember. In this case, the reading will be given as “HI green,” or any other appropriate description. For example:

- ✓HYD PRESS ind (three) – HI green
- ✓FREON EVAP OUT TEMP ind: 62 ± 2
- ✓ANTISKID FAIL lt – on
- Reset DEU flag

Note the use of a colon when the verification reading is a number (see section 3.2.4). See section 3.3.4 for a discussion on the verification symbol (✓).

A talkback (tb) status is normally given following a switch action. In procedural format, talkback will always be written as “tb” in lower case letters for both singular and plural usage. The numerical quantity of talkbacks to be checked will be spelled out in lower case (i.e., four, six, eighteen) as with switch quantities.

For example:

- L OMS XFEED B – OP (tb–OP)
- FWD RCS MANF ISOL 1,2,3,4 (four) – OP (tb–OP)
- EE tb (six) – bp
- XYZ PWR – OFF (four tb–bp)

Talkbacks may be barberpole (bp), gray, or any status shown on the talkback (e.g., OP, CL, STO, etc.). The verification of a talkback without a switch action will be written similar to other verifications (section 3.3.4).

For example:

- ✓KU ANT tb – STO
- ✓XYZ tb (four) – ON

When using “clear text,” the plural of talkbacks may be used as “tbs” without an apostrophe.

For example:

Monitor four XYZ tbs for possible change in status

When confusion may result from talkbacks having different titles from each other or from the associated switch title, each talkback should be listed in a separate callout as follows:

- FWD PWR – OFF
- ✓ABC tb – bp
- ✓DEF tb – bp
- ✓GHB tb – bp

3.2.4.5 Other Control Devices

Other control devices are used by the crew with such a high degree of frequency that references to these devices are not stated, but are implied. Typical control devices are RHCs, THC, SBTC, rudder pedals, latches, handles, and knobs. The following examples show how operations with these devices will be stated:

RHC

Mnvr to attach point "C"

THC

THC: +X (10 sec)

(A colon is used here instead of a hyphen to prevent confusion with a minus sign used for the direction of a THC pulse.)

SBTC

SPD BK: 98%

Latches

Release latches (two), stow tripod

Handles

Hatch handle – CL

Knobs

CRT 1 BRT – MAX

3.2.4.6 Caution and Warning Annunciation

Various orbiter systems annunciate caution and warning (C/W) signals in one of two main ways: lights and tones. A procedural callout for a light is described in section 3.2.4.4. Tones will be specified in the clarifying comments column after the operation that causes the annunciation. The lights and tones will be identified as follows:

MA – master alarm light and tone

C/W – caution and warning message and tone

SM ALERT – system management (SM) alert light and tone

Klaxon – cabin depress

Siren – fire/smoke

Annunciating tones emanate from alert systems (C/W, systems management, etc.), navigation aids [tactical air navigation (TACAN)], and the intercom/communications system. If a tone occurs concurrently with other indications (meter, light), the tone shall always be announced first in the series. Annunciating tones always result from some event that is either crew, ground, or vehicle initiated. For example:

L1 3. AV BAY 1(2,3) FAN A(B) – OFF (SM ALERT)

3.2.4.7 Loose Equipment

A procedure may require a crewmember to use tools and other equipment stowed at various locations. So that all the equipment is at hand when needed, all required support equipment should be identified early in the procedure.

The best way of stating an instruction for obtaining and identifying all support equipment is to list the items.

The step generally begins with “Obtain:” or “Unstow:” followed by the list of equipment. The items should be grouped by stowage location so the crewmember follows a logical path to all equipment stowage areas.

In stowage lists, such as those that are already divided by lockers, horizontal lines should be used to divide the items in different trays. The locker is indicated by the boxed locker designator above its contents.

MF43K

Payload Station Cover
Window Covers (2)
Locker Locks (15)
Pin Ball-Locks (13)

In the example above, the Payload Station Cover and two Window Covers are in one tray of locker MF43K, and 15 Locker Locks and 13 Pin Ball-Locks are in another tray. In stowage lists, the quantity will be listed last in numerical form rather than being spelled out.

In specialized lists, different methods of indicating stowage locations may be used. For instance, the stowage lists in the Medical Checklist give locations in terms of kit and pallet. There are multiple kits, such as the Emergency Medical Kit (EMK) and the Medications and Bandage Kit (MBK). Each is divided into packets called pallets that are further subdivided by item. The location will be listed last for each stowed item. The kit, the pallet, and the item location will be identified in that order. For example:

Afrin nasal spray (MBK G1-1,2)
Sudafed (MBK E2-14)

As an option, stowage lists should also be divided between vehicle units such as spacelab and orbiter.

For example:

TOOLS REQD:

SPACELAB
8x150mm Screwdriver
Stubby Screwdriver
Diagonal Cut Pliers
Gray Tape
Pocket Knife
Multimeter
ORBITER
Minigrabber Test
Jump Lead (from Pin Kit)

While stowage callouts can be adapted to specialized uses, the callouts should be clear and concise. Any new method of calling out loose item stowage shall be coordinated with the Astronaut Office FDF Representative.

If an item requires further clarification, such as a quantitative value, that information should appear in parentheses directly following the item. In this usage, instead of spelling out the quantity, numerals will be used to indicate quantity. For example:

Gray Tape (~ 10 in)
12-gauge sockets (3)

Use of a tool in a procedure will be denoted by parentheses with the quantity spelled out as in the following example:

Remove closeout (twenty-seven fasteners, 5/32-in Allen Head Driver)

In the preceding example, the crew uses a 5/32-inch Allen Head Driver to remove 27 fasteners.

3.2.4.8 Combining/Simplifying Operations

If multiple control device actions are required or alternate systems can be used, the steps will sometimes be combined using commas or parentheses as follows:

use... APU CNTLR PWR (three) – ON (*if all switches operated*)

instead of... APU CNTLR PWR 1 – ON
APU CNTLR PWR 2 – ON
APU CNTLR PWR 3 – ON

use... APU CNTLR PWR 1(2) – ON (*either/or switch operation*)

instead of... APU CNTLR PWR 1 or 2 – ON

use... APU CNTLR PWR 1,3 (two) – ON (*not all switches operated*)

instead of... APU CNTLR PWR 1 – ON
APU CNTLR PWR 3 – ON

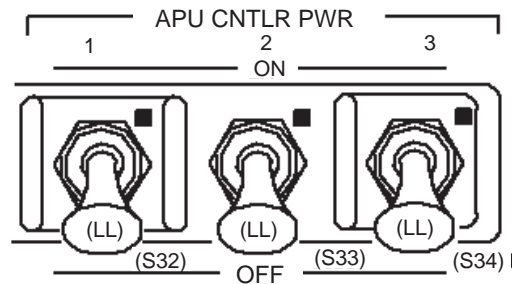
Repetitive titles will be deleted to make a procedure more readable. For example:

AFT L,R RCS He PRESS A (two) – GPC (tb-OP)
TK ISOL (six) – OP (tb-OP)

For the TK ISOL switches, the “AFT L,R RCS” is assumed from the previous step.

(This standard provides a visual point of debarkation and will be followed for consistency. However, the rule may be waived if debarkation should cause confusion.)

When it is desirable to combine control device callouts into a single statement, specific rules shall be followed. The tier bracket titles, as they appear on the panel, shall be sequentially used until the control device is uniquely and properly identified.



In the example above, to identify a single switch, use

APU CNTLR PWR 1 – ON

To identify two of the three switches, use

APU CNTLR PWR 1,3 (two) – ON

To configure all three switches, only the top tier of the panel with the quantity will be necessary.

APU CNTLR PWR (three) – OFF

Placarded titles shall always be used in the order that they appear on the panel and shall be abbreviated per the All Vehicle D&C Procedural Nomenclature document.

USE: APU CNTLR PWR 2 – ON

NOT: CNTLR PWR APU 2 – ON

The entire title of each bracket shall always be used.

USE: APU CNTLR PWR 1 – ON

NOT: APU CNTLR 1 – ON

_____or_____

USE: FLASH EVAP CNTLR PRI A,B (two) – ON

NOT: FLASH EVAP CNTLR PRI (two) – ON

When combining control devices located on different panels that have the same title, the quantities will indicate the number of actions (e.g., switch throws) required. Consider, for example, the Flight Controller Power Switches located on panels F7 and F8. In this situation, only one of the Flight Controller Power Switches (CDR or PLT) is required. However, both could be turned on. Since only one switch needs to be thrown, the callout shall appear as follows:

F7(F8) FLT CNTLR PWR – ON

Note that, in this case, even though both switches can be thrown, the switch quantity “(two)” will never be used.

Two control devices given the same title on the panel will be called out as follows:

LTG L GLRSHLD FLOOD (two) – VAR, DIM

If the light is powered off or set to BRIGHT, the rotary adjustment switch need not be listed.

LTG L GLRSHLD FLOOD – BRT

The horizontal situation indicator (HSI) source select switches are another example.

HSI SEL SOURCE (two) – NAV, 2

In such cases, both switches will always be listed together, even if only one is reconfigured.

In procedures where a particular control device to be operated depends on general purpose computer (GPC) assignment, failures, etc., there are special standards to follow. As an example, a possible switch command will be as follows:

GPC MODE 1(2,3,4) – HALT

If a single switch to be thrown depends on conditions of only one of several similar switches, the following nomenclature will be used as long as it is obvious which switch the “X” designates.

GPC MODE X – HALT

If the previous identification nomenclature (X) is not clear, more information will be given. For example:

(Aff) GPC MODE – HALT

(SM) GPC MODE – HALT

The leading designators in the two previous examples are in parentheses since they are not part of the switch nomenclature.

Note: “Aff” (“aff” stands for affected) is capitalized only as the first word of a sentence or callout; otherwise, “aff” is lowercase.

3.2.4.9 Time/Event Tagged Procedures

The general standard for referencing time (usually mission elapsed time (MET)) shall be as follows: DDD/HH:MM:SS.S where DDD is for day; HH is for hour; MM is for minutes; and SS.S is for seconds. Any portion of this may be used as applicable. Portions of crew procedures are “time related” to readouts observed on the CRT Timer or the Event Timer. Both readouts appear to the crew in standard formats:

CRT Timer

000/00:00:00 (format of readout for day/hr:min:sec)

Event Timer

00:00 (format of readout for min:sec)

For time-annotated procedures, the standards of section 3 are modified to provide “timetags” in the first left-hand column.

-01:00	PLT	CRT	✓ATT ERR & RATES
	CM		P/TV OPS
-00:03	PLT		DAP: FREE
00:00			SPEC
+00:10			DAP: A8/AUTO/VERN(PRI)

The leading zeros should be omitted if required for space constraints; however, the colons shall always remain aligned.

To conserve space, a convention has been adopted so that single figures used with an event name shall always refer to minutes (e.g., TIG-15, EI-10).

Example:

TIG-25	P	R2	1. <u>ACTIVATE HYD CIRC PUMP</u> HYD CIRC PUMP 1 – ON
TIG-24	C	O6	2. <u>ACTIVATE GPC 3</u> GPC PWR 3 – ON ✓OUTPUT 3 – NORM MODE 3 – STBY (tb-bp)

TIG-25 means “time to ignition” minus 25 minutes.

Activities can be tagged to events or upon reaching some specific parameter value. These events include main engine cutoff (MECO), altitude (H), Mach number (M), and entry interface (EI). When it is critical that an activity be performed precisely on time, an arrowhead symbol shall be used. There will be no space between the arrowhead and the number. For example:

TIG-5> P R2 HYD CIRC PUMP 1 – OFF

Usually, the time reference in a procedure is obvious by context. Unusual timetags, however, should be explained in a NOTES page or in a note on the page where the timetags are first used.

For activities tagged to events or conditions such as height (h), velocity (V), Mach number (M), etc., the placement of a space (3/32 inch or one space) will be placed before and after the symbols. For example:

h = 100k

V = 12k

M > 2.5

3.2.5 Special Operations

As with all standards there are special operational cases; the more frequently encountered ones are discussed in this section.

3.2.5.1 CRT Callouts

Reference to information displayed on CRTs shall precisely duplicate the letters, symbols, and spacing displayed on the CRT, if possible, even if this conflicts with nomenclature standards normally used in the FDE. Abbreviations shall only be used, if mandatory, to fit available space. Refer to the DPS Dictionary for orbiter CRT display formats or the Spacelab DPS/CDMS Dictionary for spacelab computer display formats.

When writing software for or procedures which use the Payload General Support Computer (PGSC), refer to the SPoC User Interface Guidelines document, and CPMP Appendix J, Portable Onboard Computer Management Plan.

3.2.5.1.1 CRT Display Format

The CRT box will identify CRT displays in procedures. The CRT box serves as a procedural step instructing the crewmember to call up the display. See figures 3-2 and 3-3 for orbiter GPC and spacelab computer display formats, respectively. For displays with keyboard buttons, such as FAULT SUMM and SYS SUMM, it is assumed that the crew will access the displays with those buttons. The CRT callouts for all other displays will be interpreted by the crew as follows:

Orbiter GPC displays

GNC 33 REL NAV means GNC, SPEC 33 PRO

SM 60 SM TABLE MAINT means SM, SPEC 60 PRO

Spacelab computer displays

SSC CDM CDMS MGMT means S/S, DISP CDM ENTER

EXC TLM TIMELINE MAINT means EXP, DISP TLM ENTER

Some spacelab displays reside in the orbiter GPCs. When referencing these displays, follow the rules for orbiter GPC callouts, rather than for spacelab computer callouts.

The Spacelab Computer Fault display is to be called by a box showing the active operating system (subsystem or experiment) and the display title. For example:

SSC FAULT or EXC FAULT

The “frame” of the CRT box will be left-justified in the operations text column when the box is used within a procedure. For example:

7. GNC 23 RCS
Ovrd FWD MANFs STAT – CL
8. DAP: FREE
GNC UNIV PTG
9. CNCL – ITEM 21 EXEC

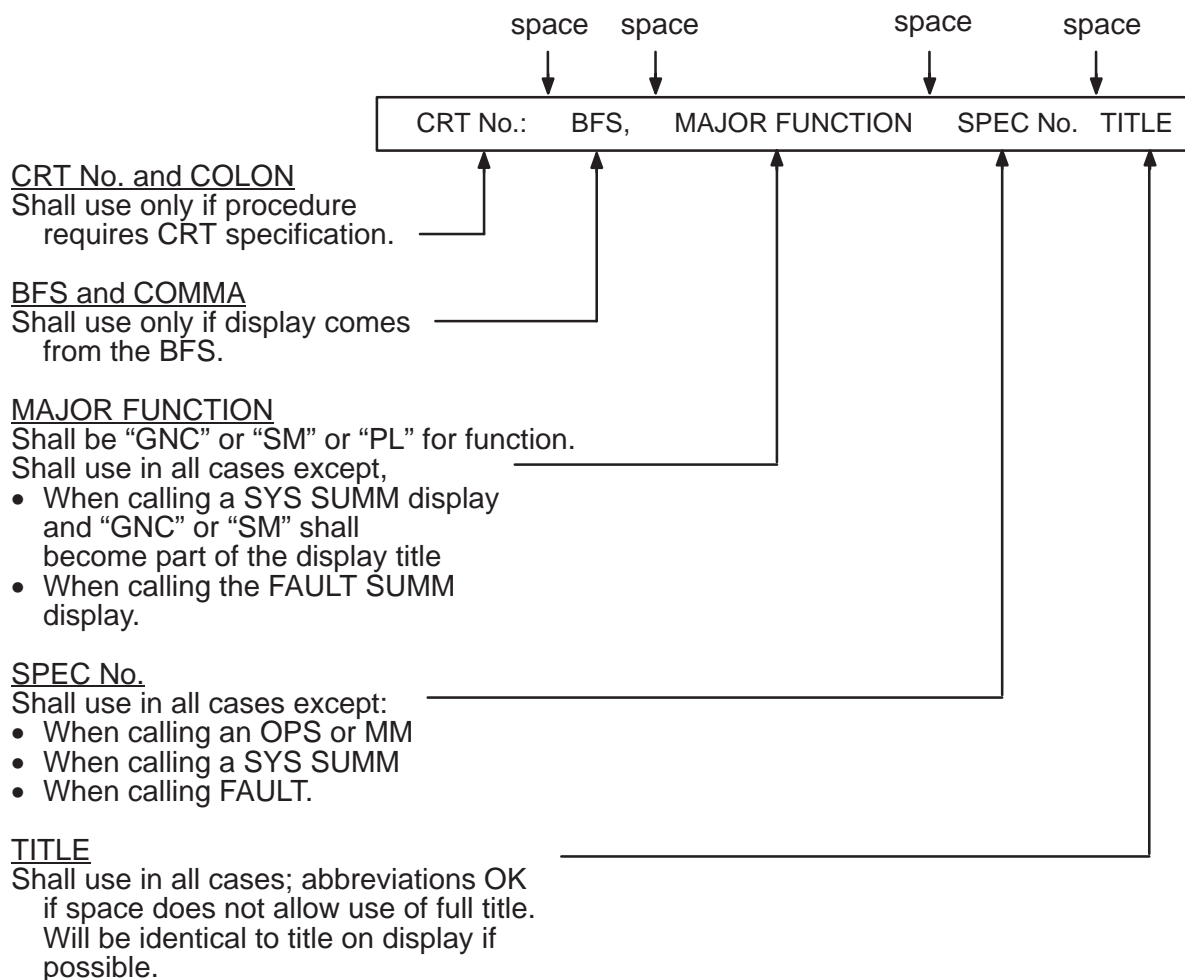
If the CRT box is part of an unnumbered step sequence, the alignment will be in the text column. For example:

SM 66 ENVIRONMENT
L1 3. HUM SEP B – OFF
 A – ON

If the display is required at the very beginning of a procedure, the CRT box will be placed to the right of the procedure title. For example:

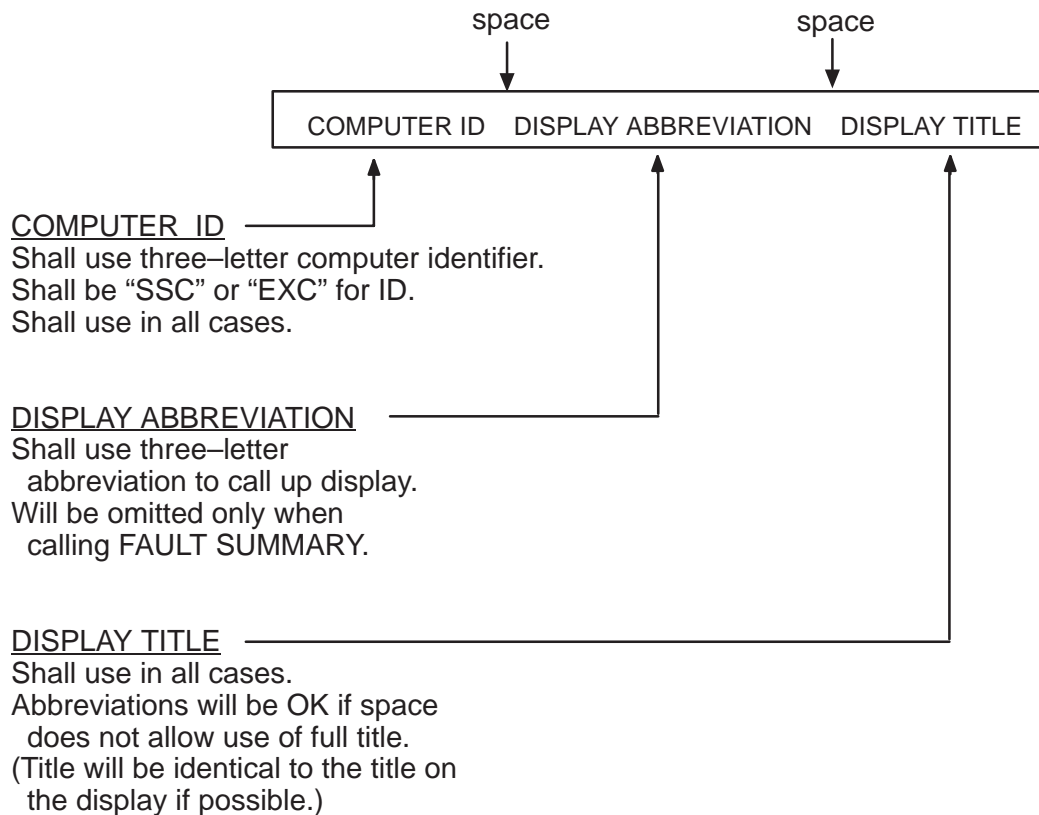
APU OIL OVERTEMP BFS, SM SYS SUMM 2

If APU OIL OUT T > 305:



All of the units shall be separated by single spaces as shown above. DO NOT USE random dashes, commas, etc.

Figure 3-2.- Orbiter GPC CRT callouts.



All components shall be separated by single spaces as shown above. DO NOT USE random dashes, commas, etc.

Figure 3-3.— Spacelab computer DDU callouts.

3.2.5.1.2 CRT Header Boxes

When it is desired to manage the use of CRTs, such as for the Ascent or Entry Checklist, header boxes shall appear at the top of each page to define the display configuration. CRT header boxes that appear later in the procedure (not at the top of the page) shall line up with the appropriate box at the top of the procedure (see figure 3-4).

Wide (8-1/2 x 11) Format Pages:



Narrow (6 x 8) Format Pages:

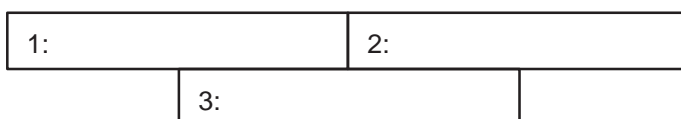


Figure 3-4.– CRT header box layouts.

Once a CRT/DDU display has been identified in a procedure using the CRT header box, subsequent references to the display will be made simply by using “CRT” in the left margin (location column), as long as no other CRT displays have been called in the interim. See 3.2.2 for using “CRT” in the location column.

3.2.5.1.3 CRT Display Callouts

Display callouts other than in the title line will sometimes be made part of a procedural callout.

GNC 21 IMU ALIGN – resel IMU

To call the SYS SUMM display, a box containing the display title will be used. For example:

GNC SYS SUMM 1

SM SYS SUMM 2

3: BFS, GNC SYS SUMM 1

(Notice that when the boxes are not used as header boxes, the boxes will be the same length as the display title.)

The FAULT display will be identified by a box containing the display title. For example:

FAULT

If it is desired to reinitialize the page, the following procedural step should be used:

SM, SPEC 99 PRO

For displays common to multiple major functions such as GPC MEMORY and DPS UTILITY, the specification of the major function is not technically necessary. However, for clarity and to avoid confusion of SPEC numbers with CRT numbers, "GNC" or "SM" will precede the SPEC numbers in the CRT box as appropriate.

1: GNC 1 DPS UTILITY

SM 76 COMM/RCDR

The major function identified should be consistent with the "known" condition of the MAJ FUNC switch.

3.2.5.1.4 Referencing Data Items on Displays

The formats for referencing data on orbiter CRT displays and spacelab computer displays are similar. The primary difference is that entries will be "executed" (EXEC) on orbiter displays but will be "entered" (ENTER) on spacelab computer displays. The principal formats for referencing CRT/data display unit (DDU) data are listed below with examples from orbiter GPC and spacelab computer displays, as appropriate.

Item number execution will be shown as follows:

Orbiter GPC displays

CRT NOMENCLATURE – ITEM NO. EXEC

CAL MODE – ITEM 26 EXEC

LOAD – ITEM 38 EXEC

Spacelab computer displays

DDU NOMENCLATURE – ITEM NO. ENTER

DCU DUMP – ITEM 34 ENTER

GLM SET 2 OPEN – ITEM 15 ENTER

Alternate item numbers will be shown in parentheses as follows:

Orbiter GPC displays

COAS POS +X(–Z) – ITEM 26(27) EXEC

Spacelab computer displays

VITR 1(2) PWR ON – ITEM 1(12) ENTER

Data entries will use the following format:

Orbiter GPC displays

CRT NOMENCLATURE – ITEM NO. D A T A E N T R Y EXEC

TRK – ITEM 8 +2 0 8 EXEC

ALTM – ITEM 1 +2 9.8 5 EXEC

Spacelab computer displays**DDU NOMENCLATURE – ITEM NO. D A T A E N T E R ENTER**MPC RT – ITEM 18 X X X ENTER

Alphanumeric entries will be underlined except for plus signs, minus signs, and decimal points. The plus or minus sign will be closed up on the first digit being entered. The decimal period, if used, will be closed up on the digits before and after. If listing alternate data entries, DO NOT underline the numbers contained within the parentheses. The following format will be used:

CONFIG – ITEM 1 +1(2,3,4,6,8) EXEC

All noncritical leading zeros for CRT input will be deleted.

For multiple data entries where one title is displayed on the CRT, the data entries will string together as follows:

CRT TIMER SET – ITEM 9 +1 3 +5 +3 2 EXEC

If each entry has a separate item number, separate lines will be used.

C1 – ITEM 30 +1 2 3 7 6 EXECC2 – ITEM 31 –7 6 2 8 EXEC

Feedback that indicates an item or data entry has taken effect will be shown in parentheses following the EXEC or ENTER if required for clarity. NOTE: Quote marks will not be used to enclose asterisks within parentheses.

Orbiter GPC displays

START MNVR – ITEM 18 EXEC (FUT – *)

JET DES R1R – ITEM 9 EXEC (no *)

Spacelab computer displays

MPC ENA – ITEM 19 ENTER (ON)

CAL IPS – ITEM 19 ENTER (*)

Verification of the status of a field will be shown as follows:

✓CRT/DDU NOMENCLATURE – FIELD STATUS

✓SOURCE – ASE

✓RF CONFIG CMD MOD – *

✓S TABLE CLR, ITEM 20 – (no unwanted data)

Note how, as in the last example, the item number of executable fields is given when verifying the status of the field. Field statuses that actually appear on the CRT will be written in all caps just as they appear on the CRT. Otherwise, the status condition will appear in lower case within the parentheses.

See section 3.3.4 for a discussion on the verification mark (✓).

When referring to a special CRT character (such as an asterisk or the up and down arrows) in the text of a procedure, the character will be enclosed in single quotes (so long as parentheses are not used) as in the following examples (see section 3.3.5.2.8):

Wait for '*' to appear
 ✓No '↑' or '↓'

Verification of a value or a range of values for a particular parameter will be shown as follows: (See section 3.3.4 for standards on the verification mark.)

✓**CRT/DDU NOMENCLATURE: VALUE**

or ✓**CRT/DDU NOMENCLATURE: RANGE OF VALUES**

✓MSN PHASE: 3
 ✓BUS VOLTS: 26.0–28.0
 ✓RF CONFIG RF POWER: 25.0 ± 5.0

Some orbiter GPC displays (e.g., SM 200 IUS) contain data fields which toggle back and forth between two data sources. Toggling fields and values will be shown as follows:

✓**CRT NOMENCLATURE – FIELD STATUS 1/FIELD STATUS 2**

or ✓**CRT NOMENCLATURE – DATA VALUE 1/DATA VALUE 2**

or ✓**CRT NOMENCLATURE – DATA RANGE 1/DATA RANGE 2**

(Field Status)
 ✓RF CONFIG CMD MOD – */blank

(Data Values)
 ✓COUNTER – ODD/EVEN

(Data Range)
 ✓AMPS: 15.1–23.1/10.0–18.0

For a CRT verification, a colon will be used when the data range is a number. When one of the data-range parameters is a negative number, the word “to” will replace the dash to avoid confusion with a minus sign. For example:

✓AMPS: –15.1 to 23.1/10.0 to 18.0
 15.1 to –23.1/10.0 to 18.0
 15.1 to 23.1/–10.0 to 18.0

Sometimes the word EXEC flashes on the CRT to prompt the crew prior to a burn or other event. This will be shown as:

EXEC (for documents developed on systems that have dashed box capability)

or “EXEC (flashing)” otherwise.

When the crew is to perform an I/O RESET EXEC on the keyboard, this action will be called out without the “EXEC” which is understood. For example:

I/O RESET

3.2.5.2 DAP Callouts

Common DAP configurations are given in the DAP book which is published in the FLIGHT PLAN for each flight. Each configuration (rates, deadbands, etc.) is identified with a letter (“A” or “B”) and a number. In the standards below, “X” is either “A” or “B” and “n” is the number from the DAP book.

DAP SPEC 20 will not be called out in a procedure as is normally done when entering data on a CRT. The DAP panel number also will not be used. Instead, the following standards shall apply:

- DAP parameters

To load DAP parameters on SPEC 20:

Change DAP X to Xn

Examples:

Change DAP A to A4
Change DAP A,B to A3,B4

To verify DAP parameters on SPEC 20:

✓DAP X set to Xn

Examples:

✓DAP A set to A4
✓DAP A,B set A3,B3

- DAP configuration

In the following, “mode” is either AUTO, INRTL, LVLH, or FREE and “jets” is either PRI, ALT, or VERN:

To configure a loaded DAP:

DAP: Xn/mode/jets

Examples:

DAP: A4/INRTL/PRI
DAP: B2/AUTO/ALT

In situations where neither VERN nor PRI is required, VERN will be called out as this is what the crews are trained to select. This is applicable to procedures that utilize the “hot stick” capability which downmodes to PRI when the hand controllers are deflected.

- Translation DAP

To use the translation DAP submodes:

DAP TRANS: X mode/Y mode/Z mode

where X and Y modes are either NORM or PULSE, and Z mode is one of the following:

NORM
 NORM, HI Z
 NORM, LO Z
 NORM, no LO Z (when leaving LO Z mode)
 PULSE
 PULSE, LO Z
 PULSE, no LO Z (when leaving LO Z mode)

Example:

DAP TRANS: NORM/NORM/NORM, LO Z

- Rotation DAP

To use the rotation DAP submodes:

DAP ROT: Roll mode/Pitch mode/Yaw mode

When the modes are either DISC or PULSE:

Example:

DAP ROT: DISC/DISC/PULSE

- Miscellaneous

When no specific DAP is required or when returning to the FLIGHT PLAN, use the following:

DAP: as reqd

Free drift mode will be called out as shown in the following:

DAP: FREE

Use “DAP: FREE” in OPS 2 if specific DAP number and jet selections are not required; otherwise, use “DAP: Xn/FREE/jets” as shown in the following example:

DAP: A4/FREE/VERN

DAP A/B selection, jet selection, and the “FREE” pushbutton are not available in OPS 1 or 3. Free drift, in OPS 1 and 3, shall be called out with the following two lines:

DAP: INRTL
 DAP ROT: PULSE/PULSE/PULSE

The use of the parentheses to indicate alternate options will be applicable as shown below:

DAP: A4/FREE/PRI(VERN)

3.3 SPECIAL FEATURES

The topics in this section are not exceptions to the standards already discussed, but rather they are enhancements to make the procedures more flexible. These features shall be used within the body of a procedure.

3.3.1 Referencing Other Documents

Referring to other procedures can conserve space by preventing repetition. Moreover, the use of references avoids duplicating procedures, which are difficult to keep in sync. However, care should be used so the crew is not forced to refer to so many documents or procedures that the task becomes cumbersome. This is especially true of quick response procedures. Likewise, the process of maintaining procedures containing references should not be exhaustive.

In cross-references, page numbers should only be used when referencing procedures within the same book. The page number will be used without prefixes (such as p. or pg.) for consistent use throughout the FDF. If some books use prefixes and some do not, confusion may arise. However, if procedures from another book are referenced, page numbers shall not be used since the book manager usually has limited control over the referenced book's page numbering.

If the current procedure/activity is to continue after the referenced procedure is completed, the expression "Perform..., then:" will be used. The next text line is normally an independent procedural step and will not be indented. In long-form malfunctions, the word "then" will be omitted from the "Perform" expression.

If the current procedure is completed concurrently with the referenced procedure, the format will use the expression "Go to..." and the crew will exit the procedure. Exit symbols are not needed for a "Go to" expression.

References will use the following format and will provide only the information necessary to completely identify the procedure and its location:

PROCEDURE TITLE, additional information (BOOK, MAJOR TAB), page number

Book titles may be omitted when referencing procedures in the same book. (A flight supplement is considered the same book as its generic counterpart when they are ringed together for flight.) The same applies to major tab titles. The book abbreviations found in CPMP, Appendix D (addendum A, FDF Reference) shall be used for FDF documents.

NOTE: Minor tabs will not be called out in references unless they are required to uniquely locate the procedure. In other words, minor tabs will be called out only when there are two versions of a procedure with the same title under the same major tab but different minor tabs. In this case, the callout is (BOOK, MAJOR TAB; MINOR TAB).

Examples:

Perform SINGLE G2 GPC OPS, steps 3 thru 9 (ORB OPS, DPS), then: *Standard callout.*

Perform SINGLE G2 GPC OPS (ORB OPS, DPS), then: *No additional information needed; i.e., all steps are to be performed.*

Perform SINGLE G2 GPC OPS (DPS), 4–2, then: *Referenced procedure is within the same book. The page number in references will be listed without any prefixes such as p. or pg.*

Perform SINGLE G2 GPC OPS, 4–2, then: *Referenced procedure is within the same book and the same major tab.*

Perform RMS PWRDN (PDRS OPS), then: *Procedure title same as major tab.*

Go to SINGLE G2 GPC OPS, steps 3 thru 9 (ORB OPS, DPS)
Will not return to the calling procedure.

The “FS” in a “Book” title will be called out when referencing a procedure in a flight supplement that has a major tab with the same title as the procedure in the generic book.

Example:

Go to LOAD PCMMU FORMAT (ORB OPS FS, COMM/INST)

Procedures referenced in timelines will follow the same general standard with minor variations.

Examples:

POST-SLEEP ACTIVITY (ORB OPS, CREW SYS)

“Perform..., then” is understood but not written in timelines such as FLIGHT PLAN, Post Insertion, etc.

Perform RAD ACT [4]

Procedure is given within block 4 somewhere in the vicinity of the timeline where it is called out

Go to RAD ACT [4] (DEORBIT PREP, D/O PREP BACKOUT)

Procedure in timeline as referenced from another book

When referring to cue card procedures, the phrase “Cue Card” will be used for the book title, and the title of the card, if any, will be substituted for the major tab.

Examples:

Go to TACAN DLMA (Cue Card, GNC)

Perform LEAKING OMS BURN (Cue Card) *(No card title)*

The Orbit Pocket Checklist and the orbiter Malfunction Procedures (or Spacelab Malfunction (Module, Pallet) Procedures) contain some duplicated procedures. The only variation between these procedures, other than line format, is that a malfunction procedure cross-reference provides the exact block of the long-form malfunction procedure where the crew must enter after completing the quick-response actions taken from the Orbit Pocket Checklist. In the Orbit Pocket Checklist, the procedure will call out the block number of the malfunction procedure that contains the quick-response procedures. The quick-response procedure and the follow-on long-form malfunction procedure together make up a “super mal.” In both books, the reference to these procedures in the Orbit Pocket and in the malfunction super mal will read:

Go to MAL, MAJOR TAB, procedure or section no. [Block or Super Mal No.]

Examples:

Go to MAL, RCS, 10.1 1.2 *Callout as given in Orbit Pocket C/L referencing Super Mal 1.2 in section 10.1*

Go to MAL, RCS, 10.1a 23 *Same callout as given in MAL referencing block 23 of malfunction procedure 10.1a*

For references within a long-form malfunction procedure in a different section, the procedure will read:

Procedure Title, MAJOR TAB, section no. Block No.

Within the same malfunction section the procedure will read:

Procedure Title, section no. (with Major Tab for SSRs) Block No.

or

Section no. Block No.

See section 5 for more information on quick-response and malfunction procedures.

When referring to the physical document rather than to the content, use the clear text format that best conveys the intent.

Examples:

Install EPS Cue Card

Make the following P&I changes to the ENT C/L:

3.3.2 Note/Caution/Warning

There are occasions when additional information or clarification is required to support a particular procedural operation. There are three types used in the FDF: notes, cautions, and warnings. The type used depends upon the impact of not providing this information. The information will be indented from the other procedures on the page to set off the data more clearly. Notes, cautions, and warnings shall always be placed before the operation they are amplifying.

Notes shall provide amplifying information of a general nature and shall be identified by the word NOTE, underlined, capitalized, and centered above the associated text. A blank line (before and after) will separate the note information from other text. Only when space is limited will the note be given on one line. For example:

NOTE

System warmup takes ~4 min

or

NOTE: System warmup takes ~4 min (This example shall be used only for single-line text where vertical space must be conserved.)

Cautions shall provide information/instructions necessary to prevent hardware damage or malfunction. They shall be identified by the word CAUTION, underlined, capitalized, and centered above the associated text. The caution text shall be prepared in block style and shall be enclosed within a single-line “boxed” border, which will be separated from other text with a blank line before and after the caution box. (Caution boxes in malfunction procedures logic diagrams will use unique formats; see section 5.)

CAUTION
MN Pump may be damaged if APU
started with HYD ACCUM P zero

Warnings shall provide information/instructions necessary to ensure crew safety. They shall be identified by the word WARNING, underlined, capitalized, and centered above the associated text. The text of the warning, which is block style, will then be enclosed in a double-line box, which will be separated from other text with a blank line before and after the warning box. (Warning boxes in malfunction procedures logic diagrams will use unique formats. See section 5.)

WARNING
Side hatch should not be opened until
ground confirms external atmosphere
is clear of contamination

To remain effective, cautions and warnings should not be overused. Some criteria to follow in using them are:

- Do not attempt to tell the crew more than they need to know. If the crew cannot affect the situation, do not address it.
- Procedural steps will not be placed within notes/cautions/warnings. If actions are required to correct or avoid a hazard, the actions will follow after the note/caution/warning.
- Assume that the crew will follow given procedures unless there is a very good reason to believe otherwise. In other words, do not use cautions or warnings to tell the crew what will happen if they do not follow procedures.
- Be precise in wording. It shall be desirable to grasp the entire context of a caution or warning in a single glance.
- Multiple warnings and cautions shall use a single box with a line dividing the independent messages. Independent notes will be separated by a blank line. For notes only, add an ending period for all sentences except the last.

Examples:

<u>WARNING</u>
If $-dP/dT$ is 0.55 psi/min (OSH), loss of vehicle atmosphere imminent
When $PPO_2 < 2.2$, emergency breathing apparatus reqd ($dP/dT \times 0.2 \approx PPO_2$ decay rate)
If, after alarm, $O_2(N_2)$ flow > 1.0 : assume flow rate exceeds 5.0 lb/hr (OSH)

<u>CAUTION</u>
MN Pump may be damaged if APU started with HYD ACCUM P zero
Do not reactivate affected htr sys

NOTE

MCC will call for BFS to be taken from RUN to STBY for Recorder dumping.

Ground support personnel establish comm at PS station.

RCS/OMS VALVE TEST completed by PLT

3.3.3 Conditional, Alternate, and Contingency Branches

Various situations may arise where it is necessary to allow for contingencies, alternate operations, and other conditional factors. Three formats have been developed to provide for such situations.

Where two or more clear branches develop in a procedure, conditional statements may be used to denote the various paths through the procedure. Any conditional statement will always be given before the action(s) to which it applies. For example:

1. When condition A,... *(One line conditionals. Do steps 1 and/or 2 as applicable,*
2. If condition B,... *then proceed to step 3.)*
3. ...

1. If condition A: *(Multiple operations performed for condition A or B, then*
 - : ... *proceed to step 2. The connecting line between the "if"*
 - : ... *statements and similar conditionals will only be used for*
 - L ... *mutually exclusive statements.)*
- If condition B:
 - : ...
 - : ...
 - L ...
2. ...

1. If condition A: *(Procedure exited after completing step 1, when condition A*
 - : ... *applies. Note that operations in step 1 shall be indented to*
 - : ... *show that they apply only to condition A. The proper*
 - L ... *indentation and spacing is critical as the instructions will*
 - >>
2. ... *change if these substeps are not indented.)*

Steps following the conditional statement will be indented to separate them from the body of the procedure. A blank line space is unnecessary (refer to the “step 11” example). Based on 11-point Helvetica type, the steps will be indented a minimum of 3/16 inch and a maximum of 1/4 inch.

In the previous example, the symbol “>>” will be used to indicate that the procedure is exited at that point, never to return. If this symbol is not used, the crew will proceed to the next step following the conditional statement. The symbol “>>” will not be used at the end of any procedure.

To avoid long vertical lines connecting the “If” statements, the conditional phrase with the fewest substeps should come first unless there is a chronological sequence required. Statements like “if recovered:” or “if successful:” should be used to avoid repeating long conditional statements.

If conditional statements become difficult to read due to nesting or length (three or more lines), a vertical line of dots should be used to clarify when the steps under a conditional are complete. Unless a vertical connecting line is required, the dots will be lined up under the first letter of the statement, and a “foot” (capital letter L) will be used to indicate the last step under the conditional. Between the “foot” and the first digit of the step, a minimum of two spaces will be used. For example:

- ```

11. ✓FLOW PROP VLV LOOP tb (two) – ICH
 If FES not ena:
 If EVAP OUT T 41 to 47 degF:
 12. RAD CNTLR OUT TEMP – HI
 When EVAP OUT T > 50 degF:
 : 13. FLASH EVAP CNTLR PRI A(B) – ON
 : Wait 3 sec, then:
 L 14. RAD CNTLR OUT TEMP – NORM
 If EVAP OUT T < 41 or > 47 degF:
 15. FLASH EVAP CNTLR PRI A(B) – ON
16. ANTISKID – OFF

```

In some cases, either a certain condition exists or it doesn't. If the condition does exist, then an additional set of data may be required. Since this case may be covered by the “if” statements already discussed, care should be used in creating alternate nominal procedures as in the following example:

```

.
: IF 24-HR EXTENSION
: P O7 AFT L,R RCS
: He PRESS A (two) – GPC (tb-OP)
: B (two) – CL (tb-CL)
: TK ISOL (six) – OP (tb-OP)
: XFEED (four) – CL (tb-CL)
: O8 FWD RCS
: He PRESS A – GPC (tb-OP)
: B – CL (tb-CL)
:

```

Dashed boxes will be used for alternate nominal procedures. The “condition,” similar to a boldface title, will be placed flush left (follow the rules for titles, see section 3.1.1) as the first line inside the box.

Another situation occurs when contingency (off-nominal) events must be considered. In other words, what does the crew do if a failure occurs or something happens at a particular point to prevent the normal flow through the procedure or if off-nominal actions are required at a particular point to correct for failures? Such operations will be set off by asterisks (\*) along both the left and right side of each text line. The text and asterisks will be indented from the text on the document page; however, if sufficient space is unavailable, only the asterisks will not be indented. For example:

```

* If no start:
* APU OPER – OFF
* Start another APU
*
* If second APU starts,
* shut down unstarted APU
* (Cue Card) >>

```

These contingency procedures will be inserted where the anomaly would likely occur or at points where particular action is required due to an anomaly.

### 3.3.4 Special Symbols

There are occasions where use of a symbol can eliminate the need for several words. This section explains some of the symbols used in the FDF. Refer also to section 5 of this document for symbols unique to specific documents.

- A highlighting mark. The fabrication personnel will highlight that line of text with a colored felt marker (crew copies only). The highlight mark (••) should be used to set off procedural steps that require emphasis in addition to boldface print or underlines. (NOTE: A page requiring highlighting will receive special treatment in the LOEP; see section 2.1.6.) The symbol will be placed at the right end of the line or word(s) to be highlighted. Use of this symbol shall be coordinated with the Astronaut Office FDF representative (see section 3.3.7). Normally, the requirement to highlight a line of text is a decision made by a crewmember at the FDF Crew Review.

Example:

Cutoff release THC••

- ✓ A verify mark. The checkmark tells the crew to check this item (switch, circuit breaker, etc.), and if the condition of the item does not reflect the desired state, the item should be positioned in the desired state (and MCC contacted if there is no known reason the item is not in the expected state). This mark shall be placed immediately to the left of the line of text to which it applies. The checkmark symbol shall be closed up on the character or word following the checkmark (e.g., ✓8, ✓H2O, ✓For leak), unless a space is required to indicate a blank or non-printing symbol. If a space occurs between the symbol and the following character, the implication is that a “blank” character is indicated. The verify mark shall be placed on each line to which the mark applies; i.e., the verify mark shall not be assumed from previous lines.



An exception to the use of this symbol is when the checkmark will be used with "MCC" (Mission Control Center). In this case, "✓MCC" tells the crew they must contact MCC about what they are doing or are about to do before continuing. (If the crew does not need to contact MCC before continuing but can wait until a convenient opportunity, the words "Notify MCC" or other clear text phrases will be used.) When using clear text, the first word following the checkmark will be initial cap or all caps.

When the first part of a callout is deleted because it repeats the line above, the verify mark will move to remain immediately to the left of the text. With the use of the Interleaf publishing format, the addition of the checkmark becomes too labor intensive to force a perfect alignment of the indented operational callout; therefore, a slight misalignment of an indented verification line is acceptable. (See the third line in the following example. A slight vertical misalignment between the "1" and "P" is acceptable.)

FREON PUMP LOOP 1,2 (two) – A  
 ✓H2O PUMP LOOP 1 (two) – ON,A  
     ✓1 ICH FLOW > 900  
 ✓MCC

>> An exit symbol. This symbol will indicate an intermediate point within a procedure where the crewmember is to exit, never to return to the procedure. The exit symbol will not be used at the end of a procedure.



Boxes will be used for handwritten data provided by the ground, either preflight or real time



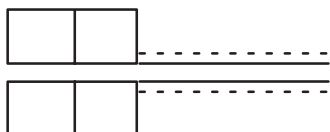
Underlines will be provided where the crew is to enter data. The added data is then available for later use or postflight analysis



Boxes will contain vehicle numbers for information pertaining only to specific vehicles. The boxes will be placed in the column used for location/panel callouts. NOTE: In switch lists, other formats will be used to conserve space



Dashed boxes will be used to denote CRT fields that are flashing. An alternative representation will be "EXEC (flashing)"



In deorbit burn procedures, the dashed and solid lines will be used along with the boxes. Depending on the value written in the boxes and flight conditions (e.g., above or below HP), the procedures written above or below the lines are to be followed

Special symbols will be used in the ASC/ENT SYS, ASC PKT C/L, and ENT PKT C/L procedures to allow quick cross-referencing during powered and glided flight.

⇒ At the end of a procedure line indicates a choice to continue to either the Glided Flight division of the ASC/ENT SYS and/or to the ASC PKT C/L as dictated by the procedure

⇒G At the end of a procedure line indicates one should continue to the Glided Flight division of the ASC/ENT SYS



- ⇒A      At the end of a procedure line indicates one should continue to the ASC PKT C/L
- ⇒        Preceding a line indicates the starting point of the procedure if coming from a procedure with a continue (⇒) icon
- ◇        Indicates one should contact MCC and if no comm, continue with the procedure

**Mathematical symbols** are often required in procedures. The following rules shall apply:

- All math symbols will have 3/32 inch (one space) before and after when used as a mathematical operator. For example:

$$P < 1000$$

$$P = 50$$

$$FC1 - START (> 10 \text{ min})$$

$$REAC \text{ VLV} - CL (EQ = 13.1 \text{ psi/min})$$

- Within an equation, no space will be left between a variable and its qualifier. For example:

$$50Y + 10X = 60$$

- If “+” and “-” are used as operators (add and subtract, respectively), 3/32 inch (one space) will be left before and after the symbol. If used as positive or negative signs, a blank space will not be left between the symbol and the numerical value. Similarly, a blank space will not be left between the approximate symbol “~” and the numerical value. For example:

$$X = 35 + 40$$

$$RF \text{ CONFIG RF POWER: } 25.0 \pm 5.0$$

$$P = +100$$

$$\text{When temp } \sim 50, \text{ go to step 4}$$

- For spillovers, break before the mathematical symbol. “If RTLS < 120K” would break as follows:

$$\text{If RTLS}$$

$$< 120K$$

- The same rules for symbols will apply to mathematical symbols placed inside a parenthesis. For example:

$$(> 30 \text{ min})$$

$$(35 + 40)$$

$$(< 20 \text{ sec tb-op})$$

### 3.3.5 Conventions of Usage

In the preparation of FDF procedures, specialized conventions have evolved. The use of parentheses, special symbols, capital letters, and structured vertical text alignment spacing techniques are well defined and have unique meanings in procedural statements. FDF documents, with limited exceptions, use the “hanging indentation” style in checklist format. The accepted authority for spelling and word usage will be Webster’s Ninth New Collegiate Dictionary. The United States Government Printing Office (GPO) Style Manual (March 1984) will remain the basis for all conventions of usage. However, deviations from the GPO Style Manual are necessary for the special requirements in FDF procedures. The specialized conventions and deviations from the GPO Style Manual are addressed in the following conventions of usage. As stated in section 3.0, the presentation of data will remain consistent within the same document and also from FDF document to FDF document.

#### 3.3.5.1 Capitalization

The United States GPO Style Manual will form the basis for capitalization (refer to the GPO Style Manual Chapter 3, CAPITALIZATION) in FDF documents. Space Transportation System acronyms and abbreviations will generally be capitalized unless specifically listed as lower case terms in the FDF Preparation Standards, Addendum B, Abbreviations Used in Procedural Nomenclature (e.g., tb, pb, cb) or in the NASA Reference Publication 1059 Revised (Space Transportation System and Associated Payloads: Glossary, Acronyms, and Abbreviations). More generic terms (e.g., MSG, Msg, msg; TK, Tk, tk; SNSR, Snsr, snsr) will appear as all capitals, initial caps, or all lower case letters depending upon specific style or usage approved for the procedure or document. The FDF Preparation Standards, Addendum B shall have priority over other references should a conflict of capitalization usage occur. The following rules will apply to FDF documents:

- Proper names will be capitalized (e.g., Houston, Earth, Mars). However, orbiter and spacelab are lower case. Similar to “airplane,” orbiter and spacelab are now regarded as generic terms. Capitalize the names of the celestial bodies Sun and Moon as well as the planets. However, lowercase the word “moon” in such expressions as “the moons of Jupiter.” Likewise, lowercase the words sunset, moonrise, and similar deviations
- Trade names will always be capitalized in accordance with trademark rules and regulations (e.g., Calfax, Velcro, Arriflex)
- Unique to FDF documents, all orbiter-flown loose equipment names and descriptions will be capitalized (e.g., Foot Tray, Gray Tape, Headset, Wet Wipes)
- Unless a unique spelling rule applies, the plural of an acronym or an abbreviation will be formed by adding an ‘s’ (lower case) without an apostrophe (Examples: cbs, FCs, msgs). The apostrophe is reserved for possessive word usage and approved contractions. As a deviation from the GPO Style Manual, the apostrophe will be omitted from the coined plurals of letters, figures, and symbols (e.g., 1990s, ABCs, OKs, \*s, ↓s)
- Basically, each procedural statement will begin with the first word capitalized unless affected by another capitalization rule or condition
- All display and control words as well as nomenclature placarded on hardware will be written in all capital letters. The All Vehicle D&C Procedural Nomenclature document shall remain as the authority for capitalization of switch callouts

Example:

O14:A BRAKES MNA – ON

- Words that are not placarded on hardware will be written in lowercase letters when used in switch callouts and switch positions

Example:

F8 APU sel (two) – FUEL,1  
Vacuum cleaner pwr – OFF

- Special words, acronyms, or abbreviations that are always written in lower case (e.g., cb, tb) will not be capitalized when they begin a procedural statement

Example:

cb MNA WCS CNTLR – op

- The first word following a checkmark that begins a statement will be capitalized, unless one of the prior two rules apply

Example:

✓cb MNA WCS CNTLR – op  
✓Latches, handles turned upward

### 3.3.5.2 Punctuation

Punctuation in FDF procedures differs slightly from traditional usage presented in the GPO Style Manual. Eight particular punctuation marks will be used in special ways: the dash, colon, comma, parentheses, slash, underscore, period, and quotation marks. Other punctuation marks will be used in the manner described in the GPO Style Manual. Likewise, the eight designated marks will be governed by the GPO Style Manual for usages not described in this section.

#### 3.3.5.2.1 The Dash

The dash is used in operational callouts to separate the object from the action. Specific rules will be used as follows:

- Spaces will be placed before and after the callout dash for each procedural operation. (In Interleaf Helvetica, the actual space used should be the equivalent of two keyboard spaces. If the text will be reduced to less than 11–point type, then the equivalent of two spaces will be required for clarity and readability in Interleaf Helvetica.) For 11–point type this equates to a minimum of 3/32 inch and maximum of 1/8 inch.

Example:

HYD CIRC PUMP – ON

- No spaces will be placed on either side of a dash when the dash is used with a talkback indicator in parentheses following a switch callout. However, a space will be placed before and after the dash for other callouts within a parentheses following a switch callout. A space will be used instead of a dash for verification of visual indicators, such as when

indicating the condition of a light, either on or off. Likewise, a space will be used to separate math symbols from the numbers within parentheses.

Examples:

HYD CIRC PUMP – ON (tb-CL)

HYD CIRC PUMP – ON (MNA FWD 1 – ON)

HYD CIRC PUMP – ON (lt on)

HYD CIRC PUMP – ON (> 3 min)

- No spaces will be placed on either side of a dash when used to indicate a range of values. However, if a parameter range contains a negative number (using the minus symbol), then the word “to” will replace the dash.

Examples:

CRYO PRESS will increase to a range of 900–1000 psi

CRYO PRESS will change to a range of –900 to 1000 psi

### 3.3.5.2.2 The Colon

The colon will be used in place of dashes when the “action” in an operational callout is a number. For 11–point type the spacing between the colon and the first character should be from 1/8 inch to 3/16 inch. In Interleaf Helvetica this will generally be three keyboard spaces between the colon and the first digit or character.

Examples:

CRYO PRESS: 900

CRYO PRESS: 900–1000

CRYO TEMP: –5 to 50 degF

The colon will be used when subentries follow after introductory lines in lists, tables, and leaderwork.

Example (see GPO Style Manual, 8.28):

Seward Peninsula:

Council district:

North Light Mining Company

Wild Goose Trading Company

Fairhaven region: Alaska Association (*single subentry runs in on the same line*)

(Note that this subentry, which is a list and not a conditional phrase, will use a colon and not a comma. The single subentry should be placed on the same line as the introductory line, which conserves space.)

Example:

Stow:

Equipment Assy Cab (EAC)

Transceiver

Unstow: Experiment Assy

The colon will be used in referencing time in the format DDD/HH:MM:SS.S (see section 3.2.4.9).

The colon will also be used after conditional phrases when subentries follow on separate lines. However, a comma will be used (except in special situations) when a single subentry conditional phrase runs in on the same line. Within FDF documents, the first word on the next line immediately after a colon will be initial cap except when rule 8 under capitalization applies (see 3.3.5.1). A word following a comma either on the same line or on the next line will be written with lower case letters. Likewise, if the text continues on the same line following a colon, the first word following the colon will be lower case unless normal grammar rules (refer to GPO Style Manual) dictate otherwise (such as quoted speech).

Examples:

If no comm:

Go to EMER PWRDN (Cue Card)

or

If no comm, go to EMER PWRDN (Cue Card)

or

If no comm: go to EMER PWRDN (Cue Card)

On MCC call:

Perform FC purge

or

On MCC call, perform FC purge

or

On MCC call: perform FC purge

If pressure > 150, continue

Inform CDR, "Procedure complete"

Report to MCC: "Initiate GSE cooling. Activate Freon Pump"

(NOTE: The colon is used in the last example since more than one sentence is placed in quotes.)

If no PL H2O Loop present:

FLOW PROP VLV LOOP 1,2 (two) – PL HX

FREON PUMP LOOP 2(1) – B

### 3.3.5.2.3 The Comma

The comma will be used, in addition to conventional usage, to imply the word "and" in FDF procedural statements and callouts.

Example:

APU CNTL 1,2 – OFF

(This reads: Both APU Control 1 and APU Control 2 are switched to off positions.)

When the comma is used to imply "and" in this manner, the unit will be written without spaces after the comma. However, spaces may be used for clarity if required.

Examples:

CAB RELIEF A – CL (tb-CL),pause

or

CAB RELIEF A – CL (tb-CL), pause

## GPC MODE – STBY,HALT,pause,STBY,HALT

or

GPC MODE – STBY,HALT, pause, STBY,HALT

#### 3.3.5.2.4 The Parentheses

The parentheses are used to clarify or explain. An additional use of the parentheses is to imply the word “or.” The parentheses are also used as a “start time” option to the timetag column when only a few timetags are required for procedures.

- When the parentheses are used as a clarifying tool, the parenthetical text material will be added to the end of the switch callout. However, when used to clarify switch quantities, the parenthetical quantity (spelled out) will be inserted immediately prior to the dash in switch callouts.

Examples:

HYD CIRC PUMP 1,3 (two) – OFF

This reads: The Hydraulic Circulation Pumps 1 and 3 are the only two out of an unnamed series to be switched to off positions. The information in parentheses will clarify the number of switches involved.

COMMODE CNTL – OFF (dn)

This reads: The Commode Control is switched to off, and the switch is then in the down position. The information in parentheses explains the position of the switch.

- When the parentheses are used to imply “or,” the text will be written as one unit without spacing

Examples:

APU CNTL 1(2) – OFF

This reads: Either APU Control 1 or APU Control 2 is switched off, depending on prior instructions or selection. Often this format is used to identify an alternate selection (e.g., APU Control 2) based on previous text lines or prior switch callouts.

O2(H2) CNTL P 1(2,3,4,5)

This reads: Either O2 or H2 is selected along with either Control Pressure 1 or 2 or 3 or 4 or 5. The alternate choices total 10 selections.

- When “start times” are placed in parentheses, the time indicator shall lead the statement or procedure rather than follow at the end. When only a few time callouts are used in a

document, this is an option to using the timetag column and conserves space by doing away with a separate timetag column. The time will begin in the “operation” column following the step number (if used).

Example:

### **INITIATE LATCH PROCEDURE**

- O14      1. Close latches  
             2. (04:14) Initiate mnvr  
             3. GPC PWR – 3

#### 3.3.5.2.5 The Slash

The slash will be used to indicate “and/or” in FDF procedures. However, for panel callouts, use the slash as listed in the All Vehicle D&C Procedural Nomenclature document, where the slash shall be used exactly as shown in the “Procedural Nomenclature” column, which may or may not indicate the “and/or” situation.

Example:

F7/A6U      FLT CNTLR PWR – ON  
                  ✓UP/DOWN arrows appear on CRT

#### 3.3.5.2.6 The Underscore

The underscore will be used to indicate the predominant conjunction(s) when two or more are given. This usage is similar to parentheses in mathematical equations.

Example:

“If A and B or C” means “if A and (B or C)”  
 “If A and B or C” means “if (A and B) or C”

The underscore will also be used to indicate the second and the third level of procedure titles.

Example:

|                                 |                      |
|---------------------------------|----------------------|
| <b>INITIATE LATCH PROCEDURE</b> | (first level title)  |
| O14 <u>CLOSE LATCH PWRDN</u>    | (second level title) |
| 1. GPC PWR – 3                  |                      |
| <u>Close Latch Activity</u>     | (third level title)  |
| 2. Initiate RMS activity        |                      |
| <u>Activate Repair Activity</u> | (fourth level title) |
| 3. Unstow tools                 |                      |

(Note: The second and third level titles may be part of the numbered step sequence; however, a fourth level title will not be numbered since a fourth level title, if numbered, would be confused with an activity.)

The underscore will be used to identify the tab callouts in a cross-reference and also to indicate a cue card title.

Example:

16. Perform LEAKING OMS BURN (Cue Card) *(Note: the cue card title)*
17. Perform SINGLE G2 GPC OPS (ORB OPS, DPS), 4-2 *(Note: the tab title)*

### 3.3.5.2.7 The Period

The period will not be used as a sentence-ending mark in a procedure unless one sentence is completed and followed immediately by another sentence in the same operational step or note. The last word (or text unit) of a note or procedural step will not end with the traditional period. Likewise, abbreviations and symbols will not use periods.

Example:

Do not set APU PWR to OFF. APU overspeed may result

Generally, each action will be placed on a separate line without a period. In a traditional manuscript, these three lines would be in a single string as step 1. However, for FDF documents each action will be placed on a single line to enable the user to quickly read and execute the procedures.

Example:

Unstow EV Gloves  
Replace LiOH Cart  
Stow EV Gloves

When using acronyms and abbreviations, the ending period will be eliminated except for the terms “e.g.”, “i.e.”, and similar terms. A period will not be used for abbreviated measurement terms, such as ft, lb, in, deg, and similar terms. Do not use a period with degrees; “degF” or “degC” will be used for temperature and the degree symbol “°” for angles. However, “°F” may appear for a labeled gauge on a panel which will be used according to the All Vehicle D&C Procedural Nomenclature document, but avoid using “°F” or “°C” in other procedures. For clarity in FDF documents, do not interchange the meaning of the degree symbol between temperature and angles.

Using a period for inch measurements will be avoided since these generally read as hard stops in the text and may result in an unclear message. However, if confusion would result from “in” as a measurement being mistaken for “in” as a word, then spell out “inch” or create a unit modifier with the preceding number. The inch symbol (") should not be used for FDF procedures unless the symbol is the only clear way to identify the measurement such as in degrees of latitude/longitude.

Examples:

Stow 5-in Wrench

Slide target 2 in in from fixture *(Note: Some clarity lost by using “in” for inches.)*

Place target 2 inches in from fixture *(Note: Clarity improved by spelling “inches.”)*

Remove bolts (length: 3 in)



### 3.3.5.2.8 The Quotation Marks

The quotation marks are used in FDF documents as either single or double quotes depending upon usage. Generally, the punctuation is outside the single quotes but inside the double quotes.

Single quotation marks will be used to refer to CRT displays or fault messages. The CRT display items and the fault messages, enclosed in single quotes, will be word for word in all capital letters unless the display uses specific lower case elements as the text appears on the screen. If punctuation (not part of the actual message) is needed after a display or fault message, the punctuation should come outside the single quote, not inside.

Examples:

Does 'I/O ERROR PL 1(2)' msg occur?

(Note that the actual message enclosed in single quotes is written in all capital letters.)

Expect fault msgs: 'I/O ERROR', 'MS ALERT', or 'DPY MNVR'. Report to CDR

(Note that the commas and the period are outside the single quotes.)

Special characters (asterisk, up/down arrows) will be enclosed in single quotes (see section 3.2.5.1.2) when used in text.

Single quotation marks will also be used in "deltas" or lists of changes to be made by the crew in checklists for contingency situations. The single quotes enclose the actual steps to be added to the procedure as directed in the pen-and-ink instructions.

Example:

At TIG-2 add:

'L1 32. AV BAY FAN (six) – OFF'

Double quotation marks will be used in conventional ways for coined words, oral comments, and other purposes as defined in the GPO Style Manual. For double quotes, FDF documents will use standard (normally inside the quote) punctuation style as defined in the GPO Style Manual.

Examples:

On egress, report to the convoy which "VFBs," phases, and panels were available for "A and B or C."

Inform CDR, "GO/NO-GO to doff suits," then activate RCS SAFING

### 3.3.5.3 Indentation

Since FDF documents use a "hanging indentation" style and also omit a closing period for instructions, the proper use of indentation shall be deemed critical for clarity, communication, and readability. The types of indentation commonly used are as follows:

1. CARRYOVER TEXT LINES. One nominal character space indentation will be used for carryover lines. (In Interleaf Helvetica use the equivalent of two keyboard spaces before

the first letter of the indented line if the first character on the preceding line is a “wide” letter; otherwise, use one keyboard space.) For 11–point type this is a minimum of 1/16 inch and a maximum of 1/8 inch.

Examples:

When this line is a carryover  
for repeating text, use appropriate indentation (*indented two Helvetica keyboard spaces*)

If this line is a carryover  
for repeating text, use appropriate indentation (*indented one Helvetica keyboard space*)

Carryover lines containing a checkmark (✓) within the sentence are treated as any other word. A checkmark after the line break will be placed at the normal indentation.

Example:

If sequence will not complete,  
✓MCC (ITEM 5 EXEC will terminate)

2. SPECIAL SWITCH CALLOUT. Two nominal character spaces prior to the first letter will be used for special switch callout situations. (In Interleaf Helvetica use two .08 tabs which is the equivalent of three keyboard spaces prior to the first letter.)

Example:

AFT L,R RCS  
HE PRESS (four) – OP  
TK ISOL (six) – GPC  
XFEED (four) – GPC

Note: The preceding example used two .08 tabs for Interleaf indentation and the dash was tabbed over until lined up. In Interleaf Helvetica, the proper alignment may require the addition of one space (after the tab) before the hyphen. For readability with Helvetica Interleaf type, two spaces will always be used after the hyphen in panel callouts.

(Note that on the second line of the preceding example, the equivalent space before and after the dash uses two Helvetica keyboard spaces in accordance with the rules for The Dash.)

3. TABLE OF CONTENTS. Two nominal character spaces will be used to indent subentries under main titles in the Table of Contents. (In Interleaf Helvetica use two .08 tabs which is the equivalent of three keyboard spaces prior to the first letter.) For 11–point type this will be a minimum of 1/8 inch and a maximum of 3/16 inch.

Example:

RELEASE OPS  
HST RELEASE  
SINGLE JOINT RELEASE  
SEP BURNS

4. SUBSTEPS OR SUBENTRIES FOLLOWING INTRODUCTORY LINES. Three nominal character spaces will be used for substeps or subentries following introductory lines. For numbered steps, the spacing will count to the units position of a step number. (In Interleaf Helvetica use the equivalent of five keyboard spaces prior to the start of the indented text, which is three .08 tabs in Interleaf Helvetica.) The fixed blank space will be the same measurement distance from indentation to indentation rather than aligning exactly under three non-standard-size type characters. This style method for Interleaf Helvetica is shown in the following examples. For 11-point type this will be a minimum of 3/16 inch and a maximum of 5/8 inch.

Example:

For ENG BURN:  
TRIM LOAD per MNVR PAD  
L,R – ITEM 6 +0.0 EXEC

Begin two ENG BURN:  
TRIM LOAD per MNVR PAD  
L,R – ITEM 6 +0.0 EXEC

5. CONDITIONAL SUBSTEPS. Substeps that are dependent on a previous statement, such as a condition, will be indented three nominal spaces with the text starting on the fourth nominal space. However, for proportional type styles, such as Interleaf Helvetica, this rule will be modified to use a fixed space measurement. (For Interleaf Helvetica three .08 tabs is the equivalent to the fixed space used to establish three nominal spaces.) For 11-point type this will be a minimum of 3/16 inch and a maximum of 5/8 inch. The connecting line between the “if” statements will be aligned with the first letter as shown below.

Example:

If verified by F9 voltmeter:  
1. (Aff) ESS BUS SOURCE MN – OFF,ON  
If bus regained:  
2. (Aff) FC – START (10 sec or P tb-gray)  
3. Go to aff BUS LOSS ACTION  
If bus not regained:  
4. Perform FC SHUTDN (Cue Card)  
(FC/MN BUS A(B,C) tbs lost), then:  
5. Go to aff BUS LOSS ACTION (ESS)

6. REPEATED PROCEDURE TEXT. If the first words of successive actions are the same, the repeated words will be omitted with indentation indicating omitted words. When lines are indented for this purpose, the checkmark will move to remain to the left of the first printed word, although a slight misalignment may occur on the line with the checkmark.

Example:

1. S-BD PL CNTL – CMD
2. MOD – OFF
3. CNTL – PNL
4. ✓PWR SEL – BOTH

7. **STEP NUMBER ALIGNMENT.** Step numbers will be aligned on the period in a single column. An exception to this rule occurs when steps will be indented to show conditional use as described in the indentation rule 5. Step numbers will be placed to the left of the procedure text with at least two nominal spaces. (In Interleaf Helvetica, use the equivalent of three keyboard spaces.) For 11-point type this will be a minimum of 1/8 inch and a maximum of 3/16 inch. One of the reserved spaces is for the checkmark when required. The first step number will be aligned with the bold title if no panel designator is used.

Example:

#### **EVAP OUT T LOW**

1. If low in only one loop: N/A (snsr fail)
2. FREON PUMP LOOP 2 – OFF
3. H2O PUMP LOOP 1,2 (two) – ON
- ~
9. FLASH EVAP CNTLR PRI A(B) – OFF
10. If no incr: FREON PUMP LOOP – OFF

8. **CONDITIONAL STEP NUMBER ALIGNMENT.** When unnumbered conditional statements are introduced into the procedure alignment, the single (and double) digit step numbers will no longer be aligned on the period as specified in rule number 7; but rather, aligned on the “ones” (unit) digit of the step number. This rule applies from procedure to procedure; however, a document or section may have a variety of step number alignments depending upon text.

Example:

#### **EVAP OUT T LOW**

1. If low in only one loop: N/A (snsr fail)
2. FREON PUMP LOOP 2 – OFF
3. H2O PUMP LOOP 1,2 (two) – ON
- ~
9. FLASH EVAP CNTLR PRI A(B) – OFF
10. If no incr: FREON PUMP LOOP – OFF
- If FREON LOOP 2(1) deactivated:
  11. O2 SYS 2(1) SPLY VLV – CL
- When EVAP OUT T activated
  - for at least 2 min:
    12. FLASH EVAP CNTLR PRI A(B) – OFF

The vertical alignment shall be considered critical to prevent a crewmember or others from misreading the steps. The vertical alignment of procedure steps determines which actions are to be skipped or followed when subentries or conditional phrases are used.

### 3.3.6 Change Bars

Change bars shall be used to identify significant changes made to FDF documents. Change bars will not, however, be used for P&I changes to be implemented by the user per PCN instructions.

The book manager is responsible for indicating the location of the change bars. Each time a book, section, or page is revised, old change bars shall be removed and only the current changes noted by new change bars. In a PCN package, when only one side of a page is revised, the reverse side, which has not changed, will retain the existing change bars as previously printed. In a milestone edition or revision, all old change bars will be removed, and only actual changes from the previous publication are indicated by change bars, as shown in figure 3-5.

Change bars shall be required for:

- All changed, deleted, or added technical data (text, tables, charts, and graphs) in the body, appendixes, notes, etc.
- The addition of a new procedure (mark the title only)
- The complete revision of a procedure (mark the title only, even if the title has not changed) ■
- A change in sequence of steps (but not cascading)
- The identification of a new, deleted, or technically changed title (in table of contents)
- The deletion of a line or series of lines (use a change bar, approximately one-half normal length) in the location of the first line that was deleted

|                        |                   |
|------------------------|-------------------|
| 1: GNC VERT SIT 2      | 2: GNC SYS SUMM 1 |
| 3: BFS, GNC VERT SIT 2 |                   |

**PLT                      SET BDY FLP**

C3                      BDY FLP – TRAIL

\* If Bdy Flap fail, cycle or hold msg \*  
 \* has occurred, ✓MCC before \*  
 \* OPS 9 transition for possible \*  
 \* workarounds to allow SSME \*  
 \* REPOSITIONING \*

**SSME REPOSITIONING (If PASS, OPS 9, and GO from MCC)**

|                        |
|------------------------|
| 2: GNC 105 TCS CONTROL |
|------------------------|

R4                      HYD MPS/TVC ISOL VLV SYS  
                              (three) – OP  
                              Hold 5 sec, ✓tb – OP

\* If less than two HYD MPS/TVD \*  
 \* ISOL VLVs open, do not \*  
 \* reposition SSMEs. ✓MCC \*

CRT2                      CLEAR MSG – ITEM 8 EXEC  
                              SELECT ID – ITEM 1 +X X (08  
                              Turnaround Position, else 02 Rain Drain  
                              Position) EXEC  
                              ✓NAME 'VFB YY' (F3 Turnaround  
                              Position, else 84) (~60 sec)  
                              MM READ – ITEM 2 EXEC  
                              (Modes 1,0,Z (6 Turnaround Position,  
                              else 3) in order, sequence run time  
                              ~2 min)  
                              After 'VFB YY (F3 Turnaround Position,  
                              else 84) COMPLETE' msg annunciated

\* If sequence will not complete, \*  
 \* ✓MCC (ITEM 5 EXEC will \*  
 \* terminate sequence) \*

5-7                                              ENT/ALL/GEN D

Figure 3-5.– Sample of change bars.

Change bars will not be used for:

- Document covers, signoff pages, and LICR/areas of technical responsibility pages
- LOEP and fabricated items listing pages
- Section or page number changes
- Tab changes
- Data cascaded down a page as a result of new data being added
- Corrections of typographical errors
- Nontechnical editorial corrections (at book manager's discretion)

Change bars will generally be placed to the right of the affected data, at the edge of the image area but within the image area of the page aligned with the last character of the page code. On multicolumn pages, the change bar may be placed either along the right side of the applicable column or along the right edge of the page image area. In two-column timeline pages, change bars will be in the outer margins (left and right).

Change bars for cue cards will be placed outside the crop marks. The change bars appear on copies but not on the flight-configured cards. For Flip Book pages, however, the change bars will be placed inside the crop marks. The Ascent/Entry Systems Procedures (AESP) Flip Book pages may have change bars placed outside the crop marks when space constraints prevent the change bars from being placed inside.

### 3.3.7 Crew Notes and Highlighting

Crewmembers may write personal reminders in their own flight copies of FDF books. These are written in ink or pencil. They can also choose to highlight specific parts of their own books. Any additions of a technical nature, including those added at the FDF Crew Review, are under the same change control as any other addition or change to the FDF and must be approved accordingly or deleted prior to flight.

Predefined highlighting is discouraged. However, if predefined highlighting is required, it shall be coordinated with the Astronaut Office FDF representative. Lines of text to be highlighted routinely in all flight copies shall be indicated by the symbol “•••” at the end of the line. (See section 3.3.4.)

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## 4.0 CHANGE DOCUMENTATION

As a given FDF document develops into a flight-ready product, the document will undergo major and minor changes. The change control process is discussed in Appendix D of the CPMP. This section provides the standards required to implement the approved changes.

### 4.1 MILESTONE EDITIONS

Milestone editions are scheduled to allow orderly implementation of changes based on formal reviews and the book's use in training. The milestone editions are as follows:

- PRELIMINARY — A "first cut" to obtain general review/comments (when required)
- BASIC — Refined book for use in flight-specific training/simulations and for flight-generic documents (when required)
- FINAL — Ready for flight use (flight-specific publications only)
- GENERIC — Ready for flight use (flight-generic publications)

The basic structure of milestone editions is defined in section 2 of this document.

### 4.2 REVISIONS

Revisions are complete replacements for the current milestone edition or earlier revisions. They are published when a significant portion of the content is changed. Revisions are generally planned for flight-generic documents in order to implement block update changes. However, revisions to flight-specific documents may be warranted in the event of major updates due to remanifesting, rescheduling, etc., when the publication of a milestone edition is not imminent.

Revisions adhere to the same standards as milestone editions and contain all new front matter, including new covers (see section 2).

### 4.3 PAGE CHANGE NOTICES (PCNs)

Page change notices (PCNs) notify all document users of changes to be made within a current milestone edition or major revision of a document. A PCN can be used to add, delete, or replace pages. A PCN can also provide instructions for user-inserted pen-and-ink (P&I) changes.

#### 4.3.1 Page Change Notice vs. Revision

As known changes to a document accumulate between cycles, the changes are compiled and published in either a milestone edition, revision, or PCN. If changes are required after the normally scheduled milestone edition is published for a flight, a decision must be made as to whether a revision or a PCN is appropriate. Such a decision is also required when block updates to a generic book are to be implemented.

Good judgment must be used in timing all publications, especially PCN releases. The goal is to provide essential data in a timely manner without overburdening the user with continuous updates. The assigned book manager and FDF Coordinator work together to make the determination of the type of publication and the production schedule.

There are several criteria for determining whether an update should be in the form of a PCN or a revision. One criterion is the number of previous PCNs. However, the number of previous PCNs should not be the major criterion. Other considerations are as follows:

- Number of active PCNs. Subsequent PCNs may have replaced all the pages affected by one or more previous PCNs. (Some pages, such as the flight-specific powerdown pages in the Orbit Pocket C/L, are updated for each flight via a PCN. Those PCNs should generally be discounted when figuring the number of PCNs already published for a document.)
- Continuity of pages affected by the change. If the LOEP looks as though the changed pages were randomly sprinkled throughout the book, a revision may be in order
- Percentage of pages affected by the change. The rule of thumb is that the dividing line between revision and PCN is the requirement to change out over half of the book. This includes pages changed out because they are on the reverse side of updated pages
- Proximity to a planned milestone edition or a block update. If a new milestone edition or a block update is imminent and cannot (or should not) be accelerated for some reason, a PCN would be appropriate for the interim

**NOTE:** A revision scheduled solely to incorporate block updates should not be accelerated to accommodate a specific flight if it means the omission of already approved block changes. Any new revision is considered by the user to be the “latest and greatest.” To publish a revision that does not contain changes approved for the next block update would result in a loss of confidence in those knowledgeable of those changes

- Availability of resources to produce and review the revision. Because every print master page of a revision must be handled by word processors and editors, every page should be reviewed for inadvertent errors that creep in during print master preparation and printing

One factor not included above is that the prime users (crewmembers and flight controllers) are likely to have written personal notes in their copies of the books. Based on past experience, changing out pages is preferred rather than recopying notes into a new book.

#### 4.3.2 General PCN Information

The preferred approach in developing a PCN is to prepare and print new pages that the user inserts in place of the old pages. To expedite the development of a PCN or to bring late changes to the crew’s attention, changes may be neatly penned onto the replacement page masters. Occasionally, it may be even more efficient to explain to the user how to mark a copy of the document to reflect a change. The latter is called a P&I change and is generally discouraged except where it would result in significant savings in time or resources. PCNs may contain both replacement pages, P&I changes, or both.

The cover of a book shall not be updated by a PCN unless the title of the book changes or if there is flight-related information such as payloads or deploy times that must be changed. If the cover is replaced, the PCN number is not added to the edition on the cover. Rather, a note stating “Cover replaced by PCN-X” is provided in the area reserved for notes to users.

The signoff page will not be updated by a PCN. This page does not fly and contains no information needed for a mission. The purpose of the signoff page is generally served by the PCN cover sheet.

### 4.3.3 PCN Cover Sheet

The PCN cover sheet (instruction page) identifies the approved change request(s) being implemented and the instructions necessary to incorporate the change(s) into a document. The PCN cover sheet may also contain other information regarding change control or use of the document. Refer to figures 4-1 through 4-3 for format.

Each PCN cover sheet shall contain the following information:

- Identification of the document being updated (as given on its front cover)
  - Title (include flight number, “flight supplement,” or other designators as applicable)
  - JSC number
  - Issue (milestone edition and revision letter if any) and milestone publication date
- Sequential number of the new PCN and its publication date
- Cover sheet page number and total number of cover sheet pages (e.g., Sheet 1 of 2)
- A list of approved change requests (Form 482s) being implemented via the PCN (refer to section 2.1.3 for 482 note designators)
- Detailed instructions for pages to be added, deleted, replaced, or modified by the user (see section 4.3.4)
- Notes to user if required
  - The statement should normally begin with “NOTE: . . . ”
  - Very significant notes, such as those regarding flight applicability of the PCN, will be presented in a skewed box to attract additional attention
  - To avoid clutter, boxes will not be used indiscriminately
- The title and signature of the person (book manager) who prepared the PCN
- The title and signature of approving authority (normally the same as the book being changed except that the branch chief is the highest level required)
- The total number of replacement pages enclosed with the PCN
  - This is normally an even number because both front and back pages are printed
  - PCN cover sheet(s) will not be counted
  - PCNs containing proprietary information will have two numbers. One is for those receiving the proprietary information and the other is for those not receiving the information
- A bar code identifying the publication (see section 2.1.1)
- The standard direction to file the PCN instruction sheet itself behind the front cover of the document. All PCN instruction sheets are retained to create a cumulative record of updates

#### 4.3.4 PCN Instructions

PCN instructions are to be clear, concise, and arranged in a manner that is easy for the user to incorporate.

- Pages will normally be added, deleted, or replaced from the front of the book to the back. This allows the entire PCN to be incorporated in one pass through the book (unless P&I changes are to be made)
- P&I changes are normally done either before or after the other work (see section 4.3.5)
- At a minimum, a separate numbered entry will be provided for each affected section
- The word “page” or “pages” should be omitted when page numbers are given
- The word “replace” followed by page numbers is understood to mean “replace the given pages with attached pages having the same numbers”
- If replacement pages are not numbered the same as the originals, the replacement page numbers will be provided (e.g., “Replace 5–5 & 5–6 with 5–5 thru 5–6b”)
- Complete sections may be called out as such; however, the range of pages will be given in parentheses for sections replaced. For example: “Replace Section 2 (2–1 thru 2–20)”
- A series (range) may be identified with either “thru” or “through” (e.g., “Replace 3–7 through 3–14”)
- Front and back pages of a single sheet may be identified by either the ampersand symbol (&) or the word “and” (e.g., “4–5 & 4–6”)
- The user will be told where to add new material (e.g., “After 6–8, add 6–8a thru 6–8h”)

#### 4.3.5 Pen-and-Ink (P&I) Instructions

Detailed text may be required when instructing the user to make changes to existing pages. The desired result is correctness with minimum user anxiety.

- A separate numbered entry will normally be provided for each affected page
- If the same change is to be made on several successive pages, the pages may be grouped under one entry
- If more than one unrelated change is to be made on a page, a separate subentry will be made for each
- After the page is identified, the specific location on the page will be identified
  - Physical placement on page (e.g., “near the top of the page”)
  - Relative to a procedure, step, block, figure, table, etc. (e.g., “under step 3”)
  - Within a procedure, step, block, figure, table, and/or component thereof (e.g., “in column z”)
  - A combination of the above separated by commas

- NOTE: Do not provide unnecessary information (e.g., if the change is within a table and there is only one table on the given page, the table need not be identified)
- After the location is identified, one of the following actions is normally given:
  - insert ... (or “add ... ”)
  - move ... to ... (or “move ... from ... to ... ”)
  - delete ...
  - change ... to ... (or “change from ... to ... ”)
  - replace ... with ...
- An ellipse ( ... ) may be used where appropriate to represent existing information
- If existing, replacement, or added text is used in the instruction sentence, that text should be enclosed in quotation marks. For example: Change “PL Pwr – OFF” to “PL MODE – OFF”
- Quoted text should be in the same font as the original (or as close a facsimile as is available)
- Several occurrences of the same change in a single instruction should be identified by the number of such occurrences. For example: Replace “PL Pwr – OFF” with “PL MODE – OFF” (3 places)
- In addition to changes in the body of the page, each instruction will provide direction to update the page code on the affected page with the current PCN number followed by the notation “P&I”
- If the PCN consists of a combination of change-out pages and P&I instructions, the printed LOEP will include the new page codes – including the “P&I” notation
- If a printed LOEP is not provided, an instruction will be given to update the existing LOEP with the updated page codes (the page code on the LOEP page(s) will also be updated)

NOTE: To aid in incorporation of P&I changes into the flight articles, sample pages marked by the book manager should be provided. These pages do not replace the detailed instructions on the PCN, but are used in conjunction with the PCN for work on the actual flight copies. They are not reproduced for distribution.

SSP Flight Data File

**PAGE CHANGE NOTICE**

JSC-48055

**SYSTEMS AOA PROCEDURES****GENERIC Rev D (Nov 16, 1994)****PCN-1 (Dec 9, 1994) Sheet 1 of 1**

List of Implemented Change Requests (482s):

SYS AOA-70  
 SYS AOA-71  
 SYS AOA-72

Incorporate the following:

1. Replace iii & iv
2. Replace 2-3 & 2-4  
After 2-6, add A2-7 & A2-8
3. After A3-2, add A3-3 & A3-4  
Replace 3-9 thru 3-14
4. Replace 5-1 & 5-2
5. Replace 8-1 & 8-2  
After 8-6, add 8-7 thru 8-10  
Delete A8-20 & A8-21  
Replace 8-24 & 8-25, 8-29 & 8-30, 8-33 & 8-34
6. Replace Section 10 (10-1 thru 10-16)

**NOTE**  
 For STS-65 and subsequent flights

**Prepared by:** \_\_\_\_\_  
 Book Manager

\_\_\_\_\_  
 Technical Representative

**Approved by:** \_\_\_\_\_  
 Head, Electrical Systems Section

\_\_\_\_\_  
 Chief, Electrical & Environmental  
 Systems Branch

Encl: 44 pages



***File this PCN immediately behind the front cover as a permanent record***

Figure 4-1.- Sample one-page PCN cover sheet (not to scale).

SSP Flight Data File

**PAGE CHANGE NOTICE**

JSC-48055

**SYSTEMS AOA PROCEDURES****GENERIC Rev D (Nov 16, 1994)****PCN-1 (Dec 9, 1994) Sheet 1 of 2**

List of Implemented Change Requests (482s):

SYS AOA-70  
 SYS AOA-71  
 SYS AOA-72

Incorporate the following:

1. Replace iii & iv
2. Replace 2-3 & 2-4  
After 2-6, add A2-7 & A2-8
3. After A3-2, add A3-3 & A3-4  
Replace 3-9 thru 3-14
4. Replaces 5-1 & 5-2
5. Replace 8-1 & 8-2  
After 8-6, add 8-7 thru 8-10  
Replace 8-15 thru 8-18  
Delete A8-20 & A8-21  
Replace 8-24 & 8-25, 8-29 & 8-30, 8-33 & 8-34
6. Replace 9-1 & 9-2, 9-7 & 9-8  
After 9-10, add 9-11 thru 9-14
7. Replace 10-1 thru 10-4
8. Replace Section 11 (11-1 thru 11-6)

**NOTE**  
 For STS-65 and subsequent flights



***File this PCN immediately behind the front cover as a permanent record***

(a) Page 1 of 2.

Figure 4-2.- Sample two-page PCN cover sheet (not to scale).



**SYS AOA GEN D, PCN-1 (continued)****Sheet 2 of 2**

Incorporate the following:

9. Replace 12-1 & 12-2
10. Replace 14-3 & 14-4

**Prepared by:** \_\_\_\_\_  
Book Manager

\_\_\_\_\_  
Technical Representative


**Approved by:** \_\_\_\_\_  
Head, Electrical Systems Section

\_\_\_\_\_  
Chief, Electrical & Environmental  
Systems Branch

Encl: 56 pages

**(b) Page 2 of 2.**

**Figure 4-2.- Concluded.**

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                      |           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|-----------|
| SSP Flight Data File                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>PAGE CHANGE NOTICE</b>            | JSC-48041 |
| <b>SYSTEMS AOA PROCEDURES</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>GENERIC, Rev D (May 17, 1993)</b> |           |
| <b>PCN-4 (Mar 24, 1994) Sheet 1 of 1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                      |           |
| List of Implemented Change Requests (482s):                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                      |           |
| REF-734                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | REF-738                              | MULTI-975 |
| REF-735                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | REF-743                              | MULTI-986 |
| REF-737                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | REF-745                              |           |
| Incorporate the following:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                      |           |
| <div style="border: 1px solid black; padding: 10px; transform: rotate(-10deg); display: inline-block;"> <b>NOTE</b><br/> For STS-65 and subsequent flights </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                      |           |
| <ol style="list-style-type: none"> <li>1. Make the following pen and ink changes on current pages 3-19 and 3-20, 3-35 and 3-36, 4-5 thru 4-8, 4-35 thru 4-38: <ul style="list-style-type: none"> <li>• Add the word 'TEMP' in front of each page number</li> <li>• Add the designator 'OI-22' conspicuously on each page (approximately 1/4-inch letters in lower right corner, if feasible)</li> <li>• Add '(P&amp;I)' after/near each page code</li> </ul> </li> <li>2. Replace vii thru x</li> <li>3. Replace 2-3 thru 2-8</li> <li>4. Replace 3-1 thru 3-4, 3-9 and 3-10<br/> Replace 3-13 thru 3-18 with attached 3-13 thru 3-20 (prior to page redesignated as TEMP 3-19)<br/> Replace 3-21 thru 3-24<br/> After 3-24, add TEMP 3-23 and TEMP 3-24<br/> Replace 3-25 and 3-26<br/> After 3-34, add attached 3-35 and 3-36 (prior to page redesignated as TEMP 3-35)</li> <li>5. Replace 4-3 and 4-4<br/> After new page 4-4, add attached 4-5 thru 4-8<br/> After new page 4-8, add TEMP 4-3 and TEMP 4-4 (prior to page redesignated as TEMP 4-5)<br/> Replace 4-13 thru 4-18<br/> After 4-18, add 4-18a and 4-18b<br/> Replace 4-19 thru 4-24<br/> After 4-34, add attached 4-35 thru 4-38 (prior to page redesignated as TEMP 4-35)<br/> Replace 4-39 and 4-40</li> </ol> |                                      |           |
| <b>Prepared by:</b> _____<br><div style="text-align: center;">Book Manager</div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                      |           |
| <b>Approved by:</b> _____<br><div style="display: flex; justify-content: space-between;"> <div style="text-align: center; width: 45%;"> Head, Orbit Procedures and<br/>Flight Data File Section </div> <div style="text-align: center; width: 45%;"> Chief, Space Shuttle Flight<br/>Planning Branch </div> </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                      |           |
| Encl: 70 pages <div style="text-align: right; margin-top: 10px;">  </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |           |
| <b>File this PCN immediately behind the front cover as a permanent record</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                      |           |

**Figure 4-3.— Sample PCN cover sheet with pen and ink instructions (not to scale).**

#### 4.3.6 PCN Replacement Pages

Replacement pages are normally provided with each PCN.

- The PCN print package will contain print masters for both front and back of each page to be replaced

**NOTE:** A PCN may include pages without changes on them (printed exactly as in the current document) if the reverse side has changed or their inclusion will allow users to replace a significant size block of contiguous pages rather than many single pages sprinkled throughout the block. Attempts should be made to make incorporation of PCNs as simple as possible without using too much paper

- Pages that are being reprinted for completeness should remain exactly as previously published:
  - Original page codes, text format, change bars, and typos (if any) will remain
  - The original print masters will be reused when feasible; otherwise, a “print master quality” copy of the original may be used
- Change bars will be used to alert the user of what has changed
  - Old change bars will be removed from pages containing changed material
  - New change bars will be provided for new material (see section 3.3.6)
  - A change bar may be omitted if a change penned into the existing material is obvious
- Printed replacement pages are not necessarily retyped
  - Required changes may be neatly penned onto old or new camera-ready masters to avoid a delay in publication
  - These changes are not considered P&I and are generally treated as normal replacement pages
  - Page code will be updated on marked-up old masters to reflect the new PCN (the notation “P&I” will not be added)

#### 4.4 FLIGHT ERRATA PACKAGE

An errata package is prepared by the FDF Management Office for each flight, immediately prior to launch (figure 4-4). It contains updates approved too late to allow for orderly publication of a formal update (revision or PCN). It can, at the FDF Manager’s discretion, also be used to implement minor changes which are not required for preflight training/familiarization and do not otherwise warrant publication as a PCN.

The errata pack is divided into three sections:

- Section A: Changes which must be uplinked real-time
  - Required for use during nominal (scheduled) operations
  - Required for a very probable anomaly

- Required for an anomaly which would not permit real-time uplink after need is identified
- Section B: Changes that will be uplinked real-time if required
  - Need is identified by specified failure, operational circumstances, or other criteria
  - Operational circumstances must allow for real-time implementation
  - Format must allow for real-time implementation
- Section C: Changes incorporated into the crew's flight books
  - Documents the content of flight books
  - Allows ground users to keep their books in sync with flight book
  - Personal, proprietary, or sensitive data will be noted but the actual data will not be given

All three of the above sections will be addressed. If there are no entries in sections A or B, the word "none" will be inserted following the description.

The errata pack will be formatted as given in figure 4-4 and described below.

- The MOD office standard font family (Arial, 11-point size) will be used for errata pack text, except where material is quoted from FDF documents
- Cover
  - Flight will be identified
  - Flight emblem (patch) may be used if available; otherwise, the SSP emblem will be used
  - Table of contents will list the sections and identify the attachments
  - Text describing the content will be provided as shown in figure 4-4
- All sections
  - The content of the section will be described
  - Affected books will be listed alphabetically
  - A numbered entry will be made under each affected book for each change
  - Multiple changes affecting the same data will be grouped together as a single entry
  - The Form 482 authorizing each change will be identified by control number and short title
  - Change requests affecting multiple books will be listed under each affected book

- For generic books, change requests that are applicable to future flights will be followed by the symbol “¥”
- All Form 482s approved for the given flight but which are not listed in a formally published document (milestone edition, revision, or PCN) are to be accounted for in the errata
- Section A
  - Each entry will have a short description of the change which is to be uplinked
  - Each entry will identify when in the mission flow the designated change must be available onboard
- Section B
  - Each entry will have a short description of the change which may be uplinked
  - Each entry will identify the condition under which the change must be uplinked
- Section C
  - Entries in this section will not be renumbered after the change has been incorporated into the crew’s flight book(s)
  - If subsequent changes are required after the affected data in the crew’s flight books have been updated, a new numbered entry will be provided
  - Changes will normally be given as P&I instructions per the standards given in section 4.3.5 for PCNs
  - Change-out pages will be provided with the errata only if P&I instructions are not practical. This facilitates rapid reproduction, distribution, and transmission of the entire errata to remote locations
  - Flight-specific data provided for each flight in the errata pack will have a standard flight-to-flight format
  - Due to the flight media and environment, the method of implementation of a specific change in the crew’s flight books and that used by ground users may not be identical. However, the results will be the same if the instructions are followed
  - The term “Info:” will precede statements used to inform ground users of material that is not contained in the errata but is provided to the crew. This is usually extensive reference data or data requiring limited distribution
  - The term “Note: ” will precede statements providing general information related to the use or status of an FDF document
- Attachments
  - Each attachment will have a sequential attachment number near the lower right edge
  - Each page of a multi-page attachment will have a page number listed after the attachment number. The format will be: “Attachment x (page n of m)”

- Each set of replacement/added pages will contain a page or card code. The code will identify the update as though it were PCN “X” (pages) or revision “X” (cards). If a subsequent replacement is required, “Y” or “Z” will be used sequentially
- Card codes for new cards, transparencies, etc. will identify the associated book and have a unique card number. This can be any number not currently in use for any other card in the book
- Pages provided as information (i.e., not intended to be inserted into a document per se) will identify the associated FDF book
- Changes that are applicable to future flights will be identified and must be covered later by a formal publication. Also included is a list of implementation priority–3 482s (refer to CPMP, Appendix D) that were not published. The latter group of 482s will be available at the Flight Activities Officer (FAO) console for real-time uplink, if required. Refer to Appendix D of the CPMP for more information on errata packages

#### 4.5 SIMULATION PACK

Some procedural changes are of such nature that they must be rapidly distributed to the simulators and MCC in order to avoid training with incorrect procedures. Occasionally, the timing of FDF publication schedules does not allow for the rapid distribution of procedural changes which are required for training. Therefore, a technique for a locally copied and incorporated change with a small distribution to key operational positions was developed: the simulation pack (sim pack). A sim pack is essentially an informally prepared copy of an FDF publication with handwritten instructions and/or replacement pages.

The sim pack is reproduced locally and incorporated into MCC and simulator FDF sets.

The following instructions apply to sim packs:

- A sim pack form is completed as shown in figure 4–5. All blocks are completed by the book manager except the sim pack number, date received, and FDF Manager’s signature. The blocks are self-explanatory with a few possible exceptions:
  - Cue card change? This is checked “yes” if the procedure being revised also has a cue card version of the procedure which must be updated
  - The instruction section should be written like the detailed instructions for a PCN. Since sim packs normally contain replacement pages, this is generally limited to a list of pages being replaced. However, P&I instructions may be given in very simple cases, such as to change a single value on a page. When the changes are actually incorporated, the personnel involved may decide to P&I the change if it is simple or less time consuming than to replace the affected pages
  - Notes to the user, such as “Retain replaced pages for future use,” should also be used in the instructions when appropriate
  - The comments box may contain special notes to the user such as “Return originals to book manager” or “Distribute to . . .”
  - Either approved 482 numbers must be given or a section head signature is required (with a phrase such as “supervisor deems mandatory for training” appearing in the AUTHORITY FOR CHANGE block)

- Replacement pages have some constraints. The input materials provided by the book manager must be of good quality to allow legible copies to be produced. Single-sided pages are required. Since the Controlled Document Production Area (CDPA) personnel provide only copying and distributing service for sim packs, the originals should be of bond copy size. However, if the pages are in a small checklist format, the proper crop marks will be used. The pages should be attached front to back as they will be inserted into the document. Thus, backs of changed pages should also be included, even if they have no changes
- The sim pack is photocopied in duplex mode, so it is important that all fronts and backs be in the correct order. Also, black ink will be used, and all marks shall be within the crop marks or they will be cut off. "SMS-" is written in the lower right corner within the crop marks of each changed page. (CDPA personnel fill in the sim pack number following the "SMS-" notation.) ("SMS-" is not to be written on unchanged pages.) Should it be necessary to insert new pages prior to the end of a section, the pages should be numbered the same as the page they are to follow plus an alphabetical suffix (see section 2.2.4). If new pages are added from different published books, the original page code (giving book, edition, etc.) shall be lined out and "SMS-" written in
- When instructions to make P&I changes are submitted, an example of the P&Is will be provided to the CDPA personnel to be used as a guide for marking pages in the controlled sets in the shuttle mission simulator (SMS), MCC, and elsewhere
- Always use the latest version of the book when providing replacement pages. Never use pages with obsolete page codes or page codes not yet published
- The sim pack's distribution list will list the affected book and flight (if applicable), the assigned sim pack number, and the title "SMS FLIGHT DATA FILE UPDATES"

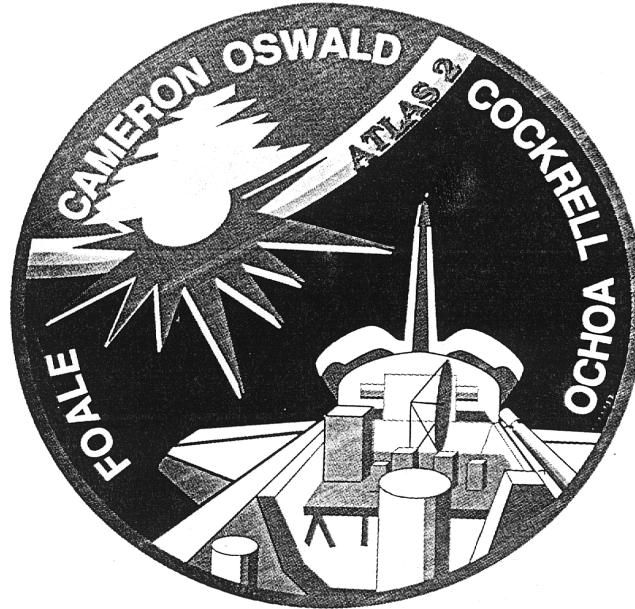
In some cases, the data to be inserted into a document are unique to the SMS. This data should be labeled "SMS UNIQUE" on each page. SMS-unique pages should be added to the document rather than replaced.

In other cases, the data to be inserted into a document are still developmental. That is, it is desirable to have the procedures used and evaluated prior to formal adoption. With FDF management approval, the sim pack pages are each labeled "Developmental." As with the SMS-unique data, these pages are additions rather than replacements. Developmental data normally are not used in integrated sims. Also, distribution of developmental data is limited to SMS and directly affected Mission Operations Control Room (MOCR) sets.

Refer to Appendix D of the CPMP for more information on sim packs.



# STS-56 FDF ERRATA



## CONTENTS:

- Section A. – Changes That Must Be Uplinked Real Time
- Section B. – Changes To Be Uplinked Real Time If Required
- Section C. – Changes Made to Crew's FDF Prior To Launch
- Attachment 1 – FDF Status for Flight
- Attachment 2 thru \_\_\_\_\_ – Change-out Pages

ALL TECHNICAL CHANGES TO THE SSP FDF, AS DOCUMENTED IN THIS ERRATA PACKAGE, HAVE BEEN APPROVED THROUGH THE CREW PROCEDURES CONTROL BOARD (Form 482) PROCESS.

SOME OF THE CHANGES APPLY TO FUTURE FLIGHTS ALSO AND WILL BE PUBLISHED AFTER THIS FLIGHT. THESE CHANGES ARE DENOTED BY (¥) FOLLOWING THE 482 NUMBER.

SOME OF THE CHANGES APPLY TO THIS FLIGHT ONLY AND WILL NOT APPEAR IN FUTURE PUBLICATIONS.

IF YOU CHOOSE TO INCORPORATE "FLIGHT-SPECIFIC" CHANGES INTO YOUR "GENERIC" BOOK, IT IS RECOMMENDED THAT YOU DO SO IN SUCH A MANNER THAT THEY CAN BE REMOVED FOR FUTURE FLIGHTS (e.g., pencil rather than ink, retain old pages, etc.).

Refer questions or comments on these changes to the FDF Manager, FDF Coordinator, or Flight Activities Officer.

**Figure 4-4.– Typical cover of errata package.**



|                                                                                                                                                                                                                    |                                                                           |                                                                                                                            |                                                                                         |                     |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------|---------------------|
| SMS FDF CHANGE NOTIFICATION                                                                                                                                                                                        |                                                                           | SIM PACK                                                                                                                   | DATE INITIATED<br>11-11-94                                                              | DATE RECEIVED (DMG) |
| BOOK TITLE<br><br>ASC CL                                                                                                                                                                                           |                                                                           |                                                                                                                            | SIM PACK NUMBER                                                                         |                     |
| BK ISSUE (Ed, Rev, PCN)<br>67 final                                                                                                                                                                                |                                                                           |                                                                                                                            |                                                                                         |                     |
| Change is for flights (Also give SMS load if load dependent):<br>575-67 Flt cycle                                                                                                                                  |                                                                           | SMS UNIQUE?<br><input type="checkbox"/> YES <input checked="" type="checkbox"/> NO                                         | CUE CARD CHANGE?<br><input checked="" type="checkbox"/> YES <input type="checkbox"/> NO |                     |
| INSTRUCTIONS TO USER:<br><br>Remove pages 1-5 thru 1-8 and replace them with the attached pages 1-5 thru 1-8b.<br><br>Pen and ink the last line of page 1-4 change from - incr to 16.7 (MA) to - incr to 16.6 (MA) |                                                                           |                                                                                                                            |                                                                                         |                     |
| AUTHORITY FOR CHANGE* (Approved 482 numbers, approved issue at print shop, supervisors deem mandatory, etc.):<br><br>ASC - 0123 Supervisor deems mandatory<br>Multi - 0456                                         |                                                                           |                                                                                                                            |                                                                                         |                     |
| *Refer to Crew Procedures Mangement Plan, Appendix D                                                                                                                                                               |                                                                           |                                                                                                                            |                                                                                         |                     |
| OTHER AFFECTED BOOKS:<br><br>none                                                                                                                                                                                  |                                                                           | Are all SIM PACKS submitted? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO                           |                                                                                         |                     |
| IMPLEMENTATION REQUIREMENTS                                                                                                                                                                                        | <input type="checkbox"/> Limited Distribution (List in comments)          | <input checked="" type="checkbox"/> NO EARLIER THAN 11-15-94<br><input checked="" type="checkbox"/> NO LATER THAN 11-18-94 |                                                                                         |                     |
| BOOK MGR (Signature/Date)<br>ASC CL Book manager                                                                                                                                                                   | SECTION HEAD (If required, Signature/Date)<br>Book manager's section head | FDF MGR (Signature/Date)<br>Lead FDF coordinator                                                                           |                                                                                         |                     |
| COMMENTS:<br><br>Return masters to book manager                                                                                                                                                                    |                                                                           |                                                                                                                            |                                                                                         |                     |

**Figure 4–5.— Sample sim pack instructions.**

QSC09958 015

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| Section    |                                                            | Page       |
|------------|------------------------------------------------------------|------------|
| <b>5.0</b> | <b><u>DOCUMENT-UNIQUE STANDARDS</u></b> .....              | <b>5-2</b> |
| 5.1        | TIMELINE FORMATS .....                                     | 5-2        |
| 5.2        | CHECKLIST FORMAT .....                                     | 5-2        |
| 5.2.1      | <u>Quick-Response Procedures</u> .....                     | 5-2        |
| 5.2.1.1    | Ladder Tabs .....                                          | 5-3        |
| 5.2.2      | <u>EVA Procedures</u> .....                                | 5-3        |
| 5.3        | MALFUNCTION DOCUMENTS .....                                | 5-6        |
| 5.3.1      | <u>Definitions</u> .....                                   | 5-6        |
| 5.3.2      | <u>Symptom Column</u> .....                                | 5-7        |
| 5.3.3      | <u>Procedures Column</u> .....                             | 5-8        |
| 5.3.4      | <u>Remarks Column</u> .....                                | 5-12       |
| 5.3.5      | <u>Bus Loss SSR Formats</u> .....                          | 5-12       |
| 5.3.6      | <u>Procedure Grouping and Numbering</u> .....              | 5-14       |
| 5.3.7      | <u>Table of Contents (TOC)</u> .....                       | 5-15       |
| 5.4        | REFERENCE DOCUMENTS .....                                  | 5-22       |
| 5.4.1      | <u>C/W and FDA Limits Tables</u> .....                     | 5-22       |
| 5.4.2      | <u>DPS/CDMS Display Diagrams</u> .....                     | 5-22       |
| 5.5        | CUE CARDS .....                                            | 5-23       |
| 5.5.1      | <u>Cue Card Pagination, Page Code, and Card Code</u> ..... | 5-23       |
| 5.5.2      | <u>Cue Card/Vehicle Coordination</u> .....                 | 5-24       |
| 5.5.3      | <u>Cue Card Logistics</u> .....                            | 5-25       |
| 5.5.4      | <u>Cue Card Configuration</u> .....                        | 5-25       |
| 5.6        | FLIP BOOK FORMAT .....                                     | 5-29       |
| 5.7        | CCTV OVERLAYS .....                                        | 5-31       |

## 5.0 DOCUMENT-UNIQUE STANDARDS

Documents discussed in this section include those having unique standards and guidelines because of special requirements dictated by in-flight use or special data format. Variances to any of the document-unique FDF standards must be approved by the FDF Manager and crew representative as described in section 1.3.

Unique standards and formats should be kept to a minimum. Greater uniformity results in less work in production, easier and quicker training, and easier comprehension and use. FDF formats that require extensive handwork and take a long time to produce, should be avoided whenever possible. These formats include artwork, cue cards, foldouts (especially if larger than 22 inches), photos, schematics, special symbols (those not on the system software), and viewgraphs.

### 5.1 TIMELINE FORMATS

Timeline formats and standards for documents produced on the Flight Planning System (FPS) are controlled by FDF Timeline Format Definitions and Standard Notes (JSC-19933). The most noticeable document-unique standard will be the FPS Timelines, which uses 8-point or larger type.

### 5.2 CHECKLIST FORMAT

#### 5.2.1 Quick-Response Procedures

Quick-response procedures contain actions that must be initiated within 5 minutes of an anomalous event. They may be contained within the body of a nominal procedure, on cue cards, in flip books, in a special section within a nominal document, or within a special book. The purpose of these procedures is to save a system and/or allow continued operations.

Orbiter systems quick-response procedures are contained in small books called pocket checklists. Ascent Pocket Checklist procedures are written assuming ET Sep or later. Exceptions should be noted in the procedure that refers to the pocket checklist.

Similar quick-response procedures in different books should look as much alike as possible to aid the crew in recognition and execution. Payload systems quick-response procedures are contained in sections of the Payload Ops Checklist or the Deploy Checklist.

The Ascent, Entry, and Orbit Pocket Checklists require unique standards because of their special in-flight use. In flight-quality pocket checklists, the quick-response procedures are printed on yellow paper. The Orbit Pocket powerdown sections are printed on white reinforced paper, behind yellow section tab-pages.

### 5.2.1.1 Ladder Tabs

An efficient means has been devised for quickly locating quick-response procedures in a pocket checklist. Each book is divided into major tabbed sections by system (section 2.2.3). Some sections are then arranged into “ladder tabs” as depicted in figure 5-1. These tabs are created by varying the physical length of the pages. When the tabbed page is opened, the right-hand side of the book has a layered appearance (fig. 5-1) with the shortest page on top. The shortest page to be used as a ladder tab page will be 5 inches in length.

As shown in figure 5-1, titles of procedures appear in boldface on the bottom (exposed portion). Page numbers on the tabbed pages are centered per FDF standard (section 2.2.4), but the page codes are positioned on the right-hand side, above the boldface title, not showing as part of the tab callout.

The rationale for positioning boldface titles on the right and left sides of the tab is as follows: In figure 5-1, assume that the user flips to page 5-7; the title on the left refers to the left-hand page, the title on the right refers to the right-hand page. That is, the procedure FC REAC/COOL PUMP appears on page 5-6 (left-hand page) and procedure FC END HTR FAIL appears on page 5-7 (right-hand page).

Ladder tabs are designed for crew use and should thus be coordinated with the crew for each revision.

### 5.2.2 EVA Procedures

In some EVA procedures, performed by IVA crewmembers inside the orbiter, the EVA cuff checklist procedures being performed by the EVA crewmembers outside the orbiter are given for reference. This gives both sets of procedures in one place, showing the sequence of both IVA and EVA actions and allows the IVA crewmembers to know what the EVA crewmembers are doing so their actions can be coordinated. The EVA and IVA actions are indicated with crewmember designations of EV and IV, respectively.

The EVA procedures from the Cuff Checklist are a replica of the Cuff Checklist page as shown in figure 5-2. The EVA procedures should be exactly the same as in the actual Cuff Checklist. Space constraints may require some variation from normal FDF Preparation Standards as reflected in figure 5-2.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |             |                                                                                                                                            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------|
| <p>○</p> <p>If MN VOLTS &lt; 26.4 and FC VOLTS &gt; 32 and FC AMPS &lt; 20:<br/>(FC DISCONNECT)</p> <p>11. MSTR MADS PWR – OFF</p> <p>If PL PRI BUS pwr lost due to FC disconnect:</p> <p>12. PL PRI (three) – OFF (tb-OFF)</p> <p>13. (Aff) FC/MN BUS – ON (tb-ON)</p> <p>If PL PRI disconnected in step 12:</p> <p>14. Perform <u>PL PWRDN</u> (10–87), then:</p> <p>If FC3 aff:</p> <p>15. PL PRI FC3 – ON (tb-ON)<br/>MNC – ON (tb-ON)</p> <p>If first FC problem:</p> <p>16. Perform BUS TIE (Cue Card), then:</p> <p>If aff FC VOLTS still &gt; 32:</p> <p>17. Go to FC SHUTDN &gt;&gt;</p> <p>18. (Aff) AC BUS SNSR – OFF, AUTO</p> <p>19. GNC I/O RESET</p> <p>If second FC failure and aff MN BUS not recovered:</p> <p>20. PL PRI (three) – OFF (tb-OFF)</p> <p>21. Go to 2nd FC SHUTDN</p> <p>If neither:</p> <p>22. Go to MAL, <u>EPS</u>, 7.4 <u>1.4</u></p> <p>○</p> |             | <p>OPCL/ALL/GEN D,23</p> <p><b>MN BUS VOLTS</b><br/><b>FC VOLTS</b> 5–3</p> <p><b>3Φ AC MTRS STOP (Over)</b><br/><b>AC VOLTS</b> (5–6)</p> |
| <p><b>AC OVERLOAD</b><br/><b>ESS BUS V LOW</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>5–7</p>  | <p><b>CNTL BUS V LOW/BUS RPC</b><br/><b>CNTL BUS SHORT</b> (5–8)</p>                                                                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <p>5–9</p>  | <p><b>FC COOL PUMP ΔP</b><br/><b>FC1(2,3) H2 PUMP</b> ↑↓</p>                                                                               |
| <p><b>FC REAC VLV</b><br/><b>FC COOL P</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <p>5–11</p> | <p><b>FC H2O RLF T</b> ↑↓</p>                                                                                                              |
| <p>○ <b>FC DELTA V 1(2,3)</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <p>5–13</p> | <p><b>FC (H2O LINE) pH HIGH</b></p>                                                                                                        |
| <p><b>FC SHUTDN (1st)</b><br/><b>2nd FC SHUTDN</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <p>5–15</p> | <p><b>BUS TIE/FC SAFING</b><br/><b>CRYO</b> (Over)</p>                                                                                     |
| <p><b>BUS LOSS ID</b> (5–20)</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <p>5–25</p> | <p><b>BUS LOSS ACTION</b></p>                                                                                                              |

Figure 5–1.– Example of “ladder tabs” in quick-response procedures.

FOR RMS/PRLA FAILURES (Cont):

PRLA OPEN/CLOSE 9

Refer to PAYLOAD RETENTION LATCHES figure, 14-9, as reqd

## PRLA OPEN/CLOSE

## AIRLOCK – RATCHET WITH 7/16 SOCKET

#### IV Verify PRLA PWR OFF

- EV 1. Insert ratchet onto EVA drive of latch
2. Rotate ratchet in release direction (toward trunnion) to shear pin
3. Verify white marks (3) not parallel on opposite side in shear pin view port
4. Continue to rotate drive approx 5 revs to disc gear train from drive shaft

To open latch:

- Continue rotation in release direction (toward trunnion) until latch open against hard stop

To close latch:

6. Rotate EVA drive in opposite direction of release (away from trunnion) until latch closed against hard stop

IV Verify PRLA talkback LAT or REL

EVA CUFF C/L

38

12/10/91

IV MA73C:C  
:D

cb MCA PWR AC1 3Φ MID 1 – cl  
AC2 3Φ MID 3 – cl

A6U

- To • PL Latches op/cl, perform:
- PL RETEN LAT 1(2,3,4,5) tb – LAT(REL)

**Figure 5–2.– IVA procedures showing integrated EVA (Cuff Checklist)/IVA procedure.**

### 5.3 MALFUNCTION DOCUMENTS

Malfunction procedures (mals) require unique standards because of their requirement for a special format that facilitates troubleshooting. The format will be a logic diagram beginning with a symptom (off-nominal condition) and leading through the logic and action necessary to solve the problem.

These procedures are used to cope with systems or equipment failures that require a diagnostic process to determine the nature of the failure and the corrective action or, if normal conditions cannot be restored, the extent of degradation and the effects on subsequent operations.

Procedures should be written to cover all significant single failures. Failure isolation should be complete only to the point where the resultant status and necessary corrective action are determined. Corrective action should then be indicated if necessary.

In general, double unrelated failures will not be covered in malfunction procedures. This stipulation is necessary to prevent the procedures from becoming unmanageably complex. However, when the necessary steps of a procedure include logical branches that represent double failures, it may be convenient to include them.

Any malfunction procedure entered from a checklist should not repeat the checklist steps. This is to prevent the crew from having to search through the malfunction procedure to find out where they should be. Super mals, to be discussed later, are an exception.

Malfunction procedures should be developed to be used independently of the ground, if possible, since tracking coverage limitations, communications difficulties, and time criticality may require this independence.

Malfunction procedures should be written at a reader level for users who have a general systems knowledge but are not system specialists. They are used in the following ways:

- For training of the flight crew and the ground support personnel. The procedures should give a comprehensive understanding of the spacecraft systems, the characteristics, and the operating limits. In the event of a malfunction, the procedures show the limitations and capabilities of the resultant configurations or alternate operating modes, as well as optimum operating techniques to be used.
- For use by the flight crew and the ground support personnel during a mission. The procedures ensure a plan for correct, comprehensive actions for reacting to predictable contingencies.

#### 5.3.1 Definitions

The following definitions are helpful:

- Super mal

This is a malfunction procedure that includes time-critical steps contained in an ORB PKT procedure (see fig. 5-3). If subsequent action is required, the ORB PKT (quick response) procedure will be the starting point of a logic diagram. The steps in the ORB PKT and the lead-in in the Malfunction Procedures book are identical except when reference is made to follow-on action. The reference to a malfunction procedure in a super mal is the specific procedure number and box in the long-form mal rather than just the malfunction title and number. Also, additional information not included in the quick-response procedure may be



included in the symptom and remarks columns. The failure blocks, giving the failed system, capability, etc., are located in the remarks column rather than in the procedures column. Anything in the super mal that is not in the ORB PKT is boldfaced in the malfunction procedure. See figure 5-3, steps 2 and 4. The super mal in figure 5-3 also includes logic diagrams referenced in the quick-response procedure blocks.

- Long-form mal

This is the name for a malfunction procedure in logic-flow diagram form (fig. 5-4), as opposed to simple checklist style. The first page of a long-form mal will be divided into three columns. The left column is called the symptom column; the center column is the diagnostic column; and the right column is the remarks column. Continued pages will eliminate the symptom column. Long-form mals provide the peripheral information to assist in both the understanding and the executing of the necessary actions and follow-on activity where appropriate. The diagnostic column provides three logic-flow diagram columns for the first page of a procedure and four columns on continued pages. See figures 5-4 and 5-5.

- Quick-response procedure

Quick-response procedures may lead to multiple long-form mals and, conversely, multiple quick-response procedures may lead to a single long-form mal. See section 5.2.1 for definition.

- Failure Recovery Procedure (FRP)

A malfunction procedure that assists the crew in recovering from a failure (not a workaround) is called a Failure Recovery Procedure (FRP). Grouped at the end of the specific sections (prior to any SSRs), FRPs are solutions to identified problems isolated in the super mals or long-form mals. FRPs generally are checklist-style procedures. However, FRPs may also be developed as long-form mals.

- Special Subroutine (SSR)

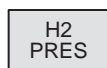
A malfunction procedure that is referenced by several other malfunction procedures is called an SSR. A bus loss SSR aids the crew in the event of an electrical bus failure. See figure 5-6.

In SSRs, normal checklist-style procedures will be used where practical. However, logic-flow format may be used if required actions are complex. SSRs are grouped at the back of each system section (following the FRPs if listed) of the various malfunction procedures books.

### 5.3.2 Symptom Column

The symptom in a long-form mal will be the original cue which alerts the flightcrew to an off-nominal condition in an orbiter or spacecraft system or component or in an experiment/spacecraft/orbiter interface. The symptom can be a C/W light, an SM ALERT light, a fault summary message, a meter reading, or an observed condition (intercom lost, shutter nonoperation, etc.). The sole purpose of the symptom column is to allow entry into the procedure. On continuation pages, this column will be deleted and more room is made available for logic-flow diagrams (fig. 5-5). All independent points of entry into a procedure, such as conditions which could activate a C/W light, etc., will be listed in the symptom column.

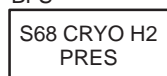
Different types of symptom blocks are used for entry into the malfunction procedures. These blocks, along with supporting information under each block, should explain and qualify the situation so the user fully understands the existing symptom or condition. The symptom blocks are arranged in the order of their C/W alarm class.



(F7)  
Light on if:  
H2 < 150 psia



BFS



Low press limits:  
H2 < 200 psia

#### **C/W or Systems Status Light Block (class 2) –**

This symptom block has the appearance of a C/W panel or system status panel light with the name of the light listed within the block. Any additional explanatory notes (e.g., C/W or systems parameters which trigger the light, etc.) should also appear under the block. This symbol will normally represent a major symptom. Any block representing an F7 panel light (primary or backup C/W) or an A8U (PDRS C/W) panel light will be shaded and appears with “(F7)” or “(A8U)” centered below it. If a light is backup flight system (BFS)–generated, the letters “BFS” should appear on the top of the box.

#### **SM ALERT Light Block (class 3) –**

This symptom has the appearance of the status panel light. This symbol will, in most cases, represent a major symptom. If the alert is BFS–generated, the letters “BFS” should appear flush left on the top of the box.

#### **Fault Summary Message (class 4) –**

This symptom has the appearance of a GPC–generated CRT fault message. This symbol, in most cases, will represent a major system. If BFS–generated, the letters “BFS” will be flush left at the top of the symptom box.

#### **Other Symptom Blocks –**

The other symptom blocks cover any malfunction symptoms not already covered. These blocks will include such items as abnormal system reading (CRT or meters), intercom lost, TV not transmitting, film not advancing, etc. Since these blocks will normally have only one exit branch and describe only a single condition for a particular symptom (e.g., O2 PRESS HI rather than O2 PRESS HI or LOW), this type of block will serve as a major malfunction symptom or as a secondary entry point for subsymptoms which are directly related to a major symptom. Directly below the block, explanatory information may be listed, such as: low or high pressure limits (depending on the particular symptom), normal pressure range, etc.

A list of switches, circuit breakers, and other related configuration data should be included in the symptom column as a memory aid in confirming nominal configuration. The nominal configuration list will be directly beneath the symptom designation and will be limited to only those switches and items that have a direct relationship to the specific failure the procedure addresses. See figure 5–4.

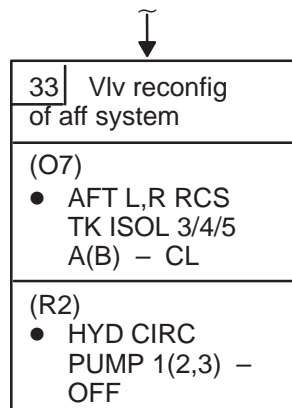
### **5.3.3 Procedures Column**

Information in the procedures column is presented in logic blocks of several types. These blocks contain the procedures, decisions, and actions required to gain control of the situation by stopping divergent rates, out–of–tolerance leaks, etc.; locating and isolating the failure; and establishing alternative modes of operation. C/W blocks alert the crew to situations which, if not corrected, may degrade the operational integrity of orbiter or spacecraft systems or experiment components or which may have critical crew safety consequences. Remote event symbols are used to reference items in the remarks column or to refer to other procedural steps.

Blocks containing crew actions will use an abbreviated checklist–style format rather than clear text to conserve space.

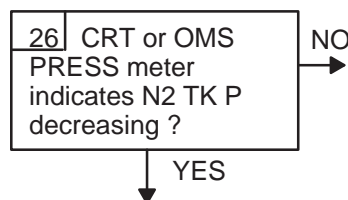
The general flow of a procedure should be from left to right and top to bottom. Blocks will be numbered in the upper-left corner.

Each procedural step, except a CRT display action, will be identified by a dot (bullet). See figure 5-4, block 1. The meaning and use of the logic blocks are as follows:



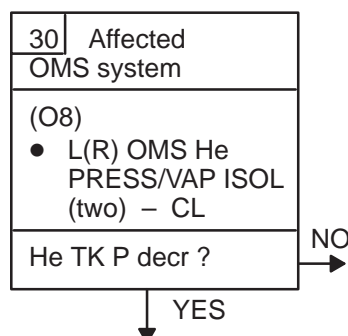
#### Action Block –

This block is used to identify crew actions only. An action block contains a descriptive title followed by a location and the action. This format also groups actions to which a note or remark may be applicable. The action could be the terminal steps of a procedural sequence. With each change of panels within the action block, a line will be drawn to indicate the panel change. An action block will contain a number, an identification or description of the action to be performed, and the sequence of crew actions required to accomplish a desired function. Switch actions will be preceded by the panel location or other location (e.g., O7) in parentheses, as shown in the example. Panel locations will be flush left, in parentheses, and on the first available line. The condition or step will be on the following line. See figures 5-4 and 5-5. Also, each action except a CRT display box will be preceded by a bullet. The switch action “dash” shall not start or begin a line of text as the first character. Actions on different panels will be separated from each other by horizontal lines. If further hierarchy is needed, dotted lines can be used.



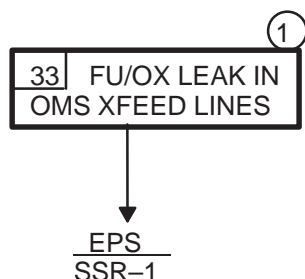
#### Decision Block –

This block represents a decision that branches procedures to alternate paths. The block asks a question that is relative to arrival at a specific condition. The block contains a number followed by a question which requires a decision. Whenever possible, a decision block will be connected to the prior action block unless the prior block in the sequence is another decision block or a procedural block. Action blocks and decision blocks will be combined into procedural blocks to conserve space and improve logic diagram flow.



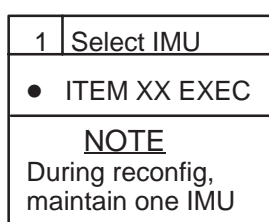
#### Procedural Block –

This block is a combined action/decision block. The lower, or decision, portion of the block contains a question relative to a panel display or orbiter/spacecraft condition. A procedural block enables branching to alternate procedure paths.

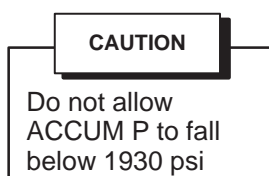
**Failure Block –**

This block contains a step number and a brief description or a statement of the failure (diagnosis). The block will be outlined with a wide border to readily identify the failure. A reference symbol may appear with this block to identify the status of the experiment or system statement in the remarks column. If special subroutines or reconfiguration procedures are required after the failure block, a special format as shown should be used. The subroutine (SSR) is indicated as shown for EPS SSR-1. For space constraints, the title of the SSR is omitted. However, if the title is essential to be noted along with the SSR number, then the SSR is placed in an action block using the “Go to” or “Perform” format.

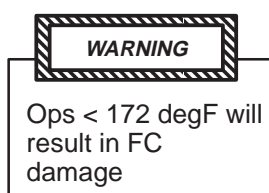
Four types of special note blocks are used in malfunction logic diagrams. These blocks are as follows:

**Special Notes –**

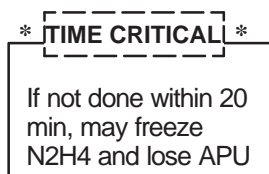
Notes may follow action items in procedural blocks to describe a status or condition the crew should be aware of prior to the next step. The notes do not involve crew safety.

**Caution Block –**

This block appears in the procedures or remarks column before the action or condition the block describes. The caution block shall provide information/instructions necessary to prevent hardware damage or malfunction. Caution blocks will not have a step number. Procedural steps shall not be placed inside a caution block.

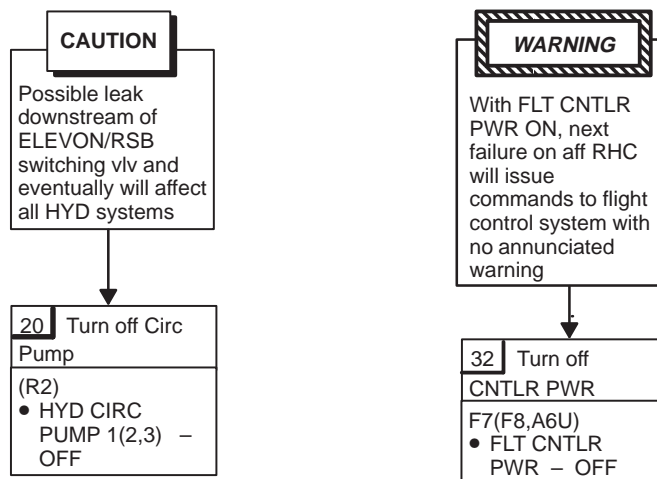
**Warning Block –**

This block appears in the procedures or remarks column before the action or condition it describes. The warning block shall provide information/instructions necessary to ensure crew safety. Warning blocks will not have a step number. Procedural steps shall not be placed inside a warning block.

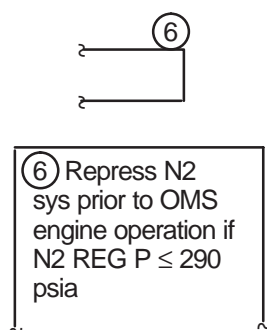
**Time-Critical Block –**

The time-critical block appears in the procedure before the action or condition it describes. The time-critical block explains the urgency with which the failure must be treated. “Time Critical” will be placed in a box flanked by asterisks. Time-critical blocks will not have block numbers.

When a procedural action block is preceded by a caution or warning block, the number box of that block shall have wide borders. This is done to alert the crew to the possibility that the information in this block may identify a problem.

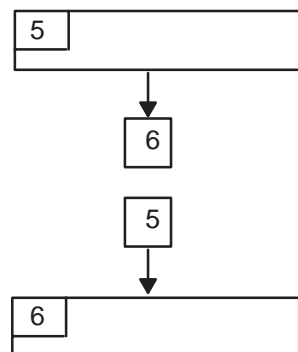


Three types of remote events symbols appear in the procedures column. They are identified as follows:



#### Reference Symbol –

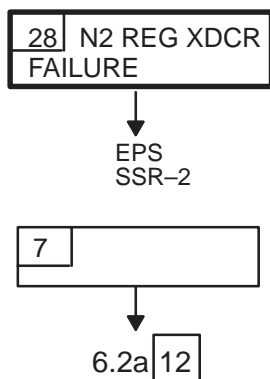
The reference symbol, consisting of a number within a circle, will be located above the right-hand corner of a procedure logic block. The reference symbol refers to an applicable statement in the remarks column. The circled number, denoting a particular statement, precedes that statement in the remarks column. The remark identifies a failure in more detail, describes the status of the system or subsystem that exists, or explains the urgency with which the failure must be treated. The notes will be numbered in sequence, left to right, then top to bottom on the page as they appear in the procedures column. Inserting a new note into the procedural flow will require succeeding notes to be renumbered.



#### Transfer Block Symbol –

The transfer block symbol acts as a link between two blocks within the same symptom. The reference follows a procedural block, decision block, action block, or failure block. The number within the box refers to the next block to be entered. This is used to reference the procedure flow on a continued page or same-page reference when it is impractical to directly link two procedural (action, decision, etc.) blocks.

The first example shows how to identify the referenced block (block 6) and the second shows how to identify the previous block (block 5). See figures 5-4 and 5-5.



#### Remote Event Symbol –

This remote event symbol refers to a step or procedure that does not fall within the same symptom. In fact, the symbol may refer to a symptom and step number of another system. This symbol usually follows a procedural, decision, or failure block and may refer to an FRP or SSR (first example) or another malfunction procedure (second example). If the symbol instructs the user to leave the book, indicate the name of the book and the major tab (underlined). If not, these indications are omitted.

The general flow of a procedure is from the left to the right and top to bottom. However, flow arrows from right to left and bottom to top are allowed to conserve space and promote clarity. Blocks are numbered left to right, top to bottom. The lowest numbered block shall always be the highest positioned block on the page in the left-most position. Other numbered blocks will follow in sequence.

#### 5.3.4 Remarks Column

The remarks column explains and qualifies the situation represented in the other columns so the user may understand the symptom and the procedural steps. It is an aid in applying the procedure to the actual condition that exists. Information presented in the remarks column should be of sufficient detail to enable the user to evaluate and understand the relative importance of the symptom and the urgency with which it must be treated. The remarks column qualifies the threshold values that trigger C/W lights or the SM ALERT light, indicates limits for meter reading parameters and the effects of exceeding these limits, and also specifies, at the point where a condition is determined, the resultant operational capability and conditions of subsequent usage. Moreover, the directions included in this column, as required, refer the user to backup procedures or other procedures and steps. The remarks should not contain actions of any kind. Actions are permitted in the procedures column only. The procedure should be complete and safe without the remarks column.

The format for the remarks column does not require the level of restriction of the symptom and procedures columns. The general guidelines of clarity and brevity should be followed. The reference symbol shall be followed by a concise statement of pertinent information.

#### 5.3.5 Bus Loss SSR Formats

Bus loss SSRs contain all subsystem reconfiguration steps necessary following the loss of a single electrical bus. SSRs also list all subsystem equipment lost and resultant onboard crew indications for each bus loss. If a bus powers one or more subbuses, the SSRs do not need to be utilized unless referenced in an SSR; i.e., each SSR stands alone for subsystem data.

The SSRs assume that a specific bus loss has been determined by a malfunction procedure or by a direct readout of bus power loss by MCC or the crew. The SSRs do not contain steps to determine the specific bus lost, but rather list the crew indications and equipment lost which aid in identifying the lost bus. See figure 5-6(b).



The following additional information refers to each column of bus loss SSR data:

- Actions

The actions column should list all subsystem reconfiguration steps necessary following a bus loss. Reconfiguration steps performed prior to starting the actions, such as from a malfunction procedure, are repeated in the actions column for completeness. No troubleshooting steps are listed since it is assumed that the bus has been confirmed to be lost prior to starting the SSR. Actions are configuration independent, making some of the reconfiguration steps verification steps. Equipment or function loss that necessitates each reconfiguration step is listed adjacent to the step in the equipment/function lost column.

- Bus isolation

Bus isolation steps do not have to be performed following bus loss since equipment being unpowered is already unpowered if the bus is dead. The bus isolation column can be used as a shopping list if power must be reduced on a particular bus for any reason. Equipment loss resulting in each isolation step is listed adjacent to the step in the equipment/function lost column if the same equipment is not already listed adjacent to reconfiguration actions column step(s). Equipment isolation steps listed in the actions column are not repeated in the bus isolation column.

- Equipment/function lost

This column should list all the equipment or functions that are lost because of bus loss. If reconfiguration action is necessary because of equipment loss, the equipment is listed adjacent to appropriate actions column step(s). If no reconfiguration is necessary, but equipment may be isolated from the bus, the equipment is listed adjacent to the bus isolation column step. Equipment lost, for which there is no reconfiguration or isolation, is listed separately.

- Crew indications

Onboard crew indications that occur when a bus fails are grouped according to the type of indication. C/W lights are listed together, as are fault summary messages (FSMs) and lights lost. Dedicated displays and tbs are grouped by panels on which they are located. The indications listed would occur immediately when the bus failed; any exceptions should be explained by a note or preceded by a qualifier, such as "If H2O Loop 2 Pump Active."

If the FSM is available in OPS 2 only, without a similar message in BFS or OPS 3, it is followed by "(2)." If the FSM is available in OPS 3 and BFS, it is followed by "(3,B)." Nothing is listed beside the FSM if it is available in all mission phases (available in OPS 2 and OPS 3 or in OPS 2 and BFS). OPS 1, 6, and 8 are not considered.

The following are special formats unique to the bus loss SSRs:

1. Actions, equipment/function lost, and bus isolation columns

The equipment/function lost column horizontal dividing lines are identical to the actions and bus isolation column lines since the equipment or function lost drives the action to be taken.

- Solid lines are used to separate the switch/circuit breaker (cb) panels and/or CRT displays. (See dashed lines for exceptions.)

- Dashed lines will be used as follows:
  - To separate rows of the same switch/cb panel
  - To separate the switch/cb panels if more than one panel is required for a particular subsystem reconfiguration (such as switching to the backup O2/N2 control system); otherwise, solid lines separate the panels
  - To separate the reconfiguration options of a subsystem (such as the cryo reconfiguration options based on the number of tank sets)

## 2. Crew indications column

- Solid lines will be used to separate the switch/cb panels and/or types of indications. (See dashed lines for exceptions.)
- Dashed lines will be used as follows:
  - To separate the conditional indications within a specific type (such as within a listing of FSMs with the same conditional as “If Star Tracker powered”)
  - To separate the indications dependent on the operational mode of a subsystem (such as to separate the indications of opening the payload bay doors in the auto mode from the indications of opening the doors in the manual mode)
  - To separate the switch/cb panels and types of indications if they are associated with the same conditional statement

### 5.3.6 Procedure Grouping and Numbering

Each procedure is numbered sequentially as follows. Major tabs (section 2.2.2) divide the book into sections; i.e., 1, 2, 3, etc. Minor tabs or symptoms (section 5.3.2) are grouped within a section by experiment or by system (starting with the number 1); e.g., the systems in section 6 are 6.1, 6.2, 6.3, etc. A subsystem that is directly related to a major symptom is identified by using the same number followed by a lowercase letter; i.e., 6.1a, 6.1b, 6.1c, etc. Tab callouts will be in 12-point Helvetica bold with the system numbers appearing on the minor tabs. Titles should be brief, concise, and related as closely as possible to the fault message and/or problem observed by the crew. ■

Step numbers and, if necessary for further subdivision, step letters will subdivide mal procedures. When bullets are used to subdivide steps, they will all be aligned to the same level to prevent confusion. If a statement is on a bullet, its substeps will be indented as usual.

Super mals (section 5.3.1) are usually located at the beginning of subsections; however, primary emphasis is on technical association with related procedures. A user locates a specific super mal via the TOC (section 5.3.7).

The FRPs and SSRs (section 5.3.1) are grouped at the back of each system section. The SSRs and FRPs may be in either a standard procedure format or a logic flow format, depending upon the complexity of the actions.



The name of the system (OMS, ECLS, etc.) is printed in boldface type in the top left-hand corner of the symptom column (fig. 5-4); the procedure serial number and symptom will be printed in boldface type in the top left-hand corner of the procedure column.

The physical date that the procedure is updated or changed in the computer system should appear in the lower left-hand corner of the page. Pagination and page codes shall be in accordance with sections 2.2.4 and 2.2.5.

### 5.3.7 Table of Contents (TOC)

Malfunction procedures are unique in that they embrace a serial numbering system that is standardized by section, system, and subsystem (section 5.3.6). This serial numbering system is illustrated in figure 5-7. As shown, the serial pattern of identification is retained even though a number is not currently being used. In these cases, the words "RESERVED" and "not used" will be substituted (respectively) for the procedure name and page number.

Super mals (section 5.3.1, fig. 5-3) receive special emphasis in the TOC where they are listed with "highlight" boxes. Figure 5-7 shows a TOC page listing the subsections of super mals. The "highlight" boxes are the user's source for locating the super mal procedures which are normally located at the beginning of those subsections with which they are technically associated.

The CRT fault messages that lead into each mal are listed in the TOC for easy identification. See figure 5-7.

All BFS messages, with their corresponding procedures, will be listed in a special index (BFS FSM INDEX) after the sub-TOC at the beginning of each section (but not in the main TOC). Fault messages with no corresponding malfunction procedure should be listed following the BFS FSM INDEX or the sub-TOC listing as appropriate.

A note in the TOC should indicate procedures entered only on MCC call or from other procedures (i.e., not through C/W or other symptoms). See figure 5-7.

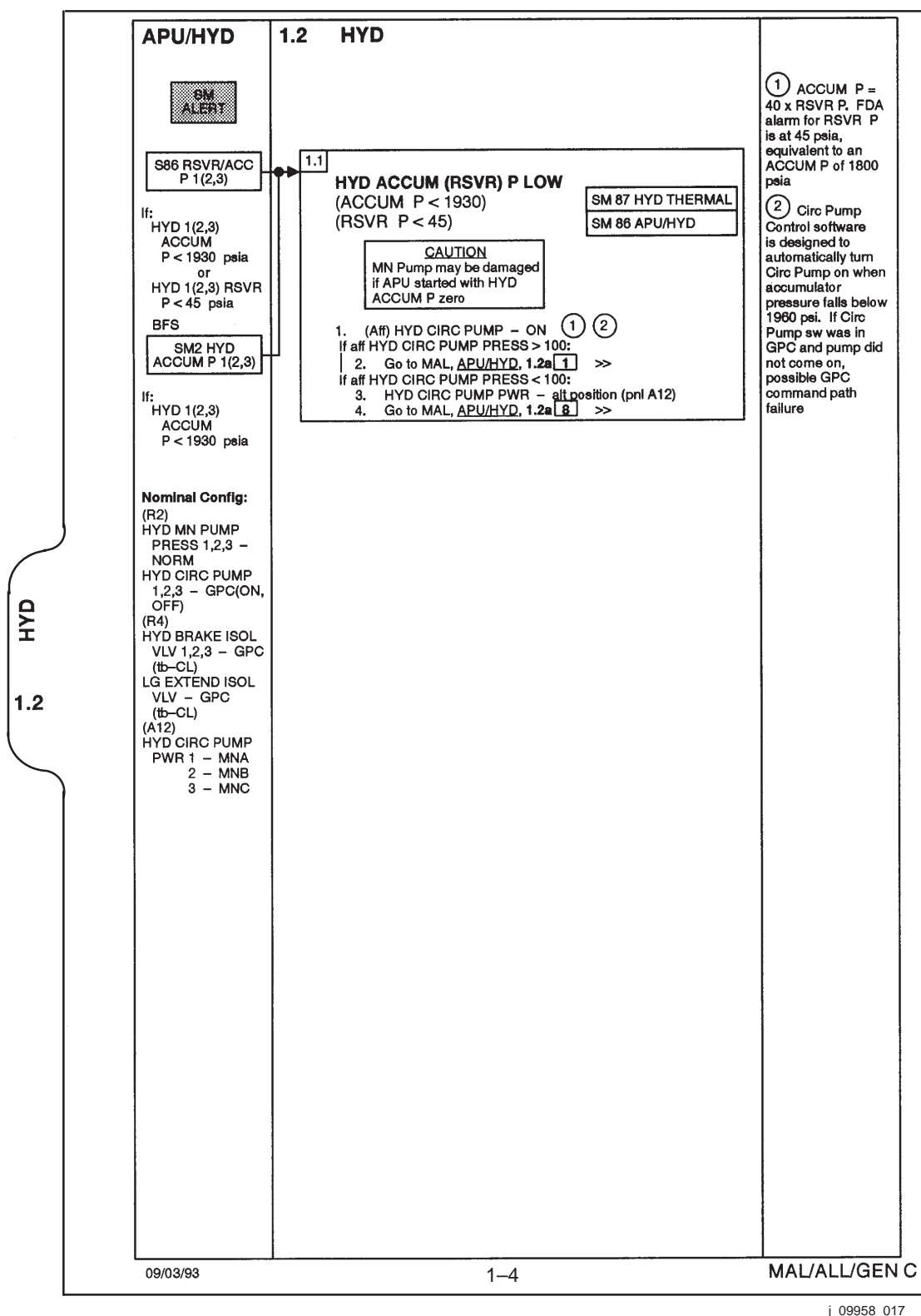


Figure 5-3.- Example of super mal.

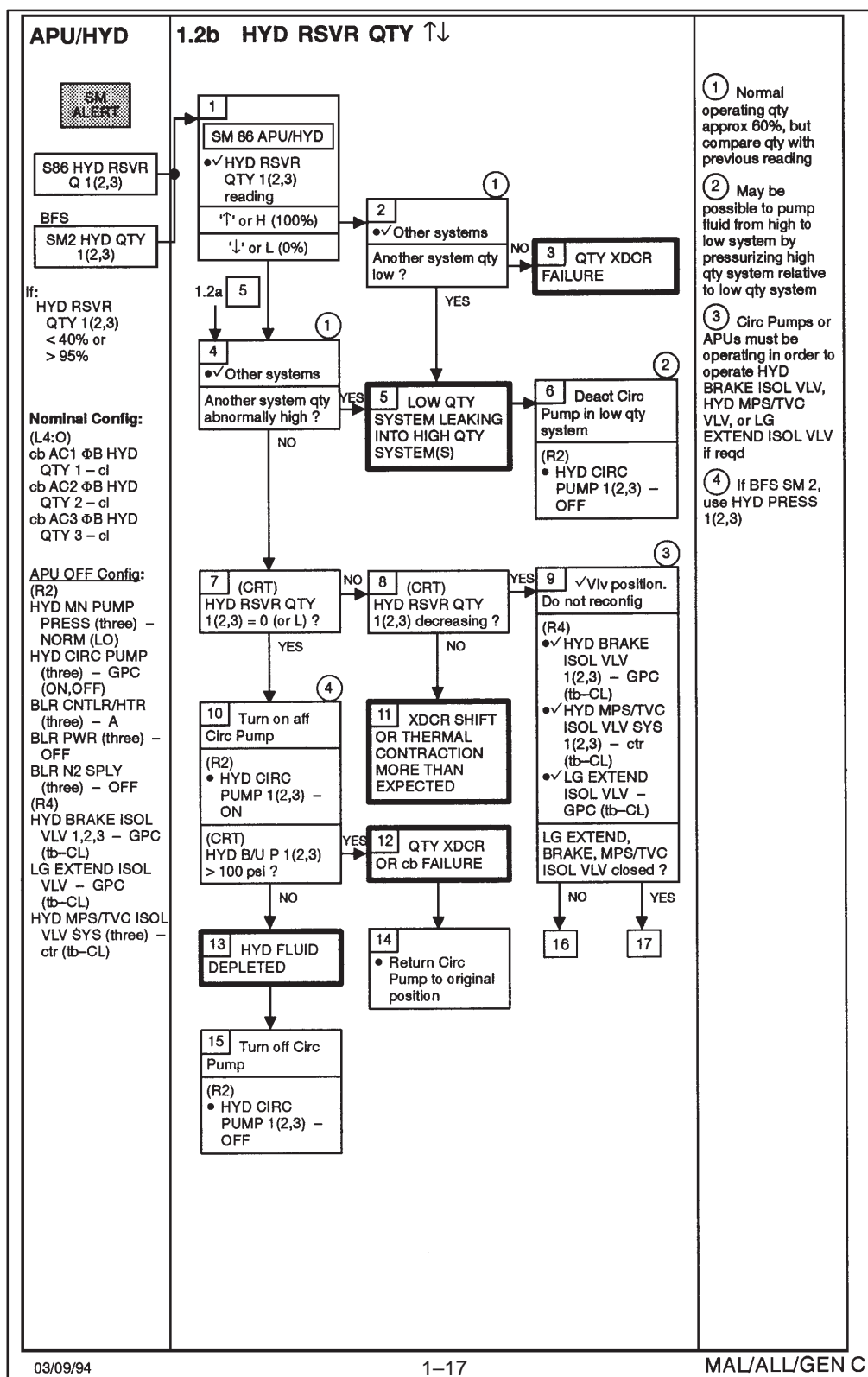


Figure 5-4.- Sample long-form malfunction procedure.

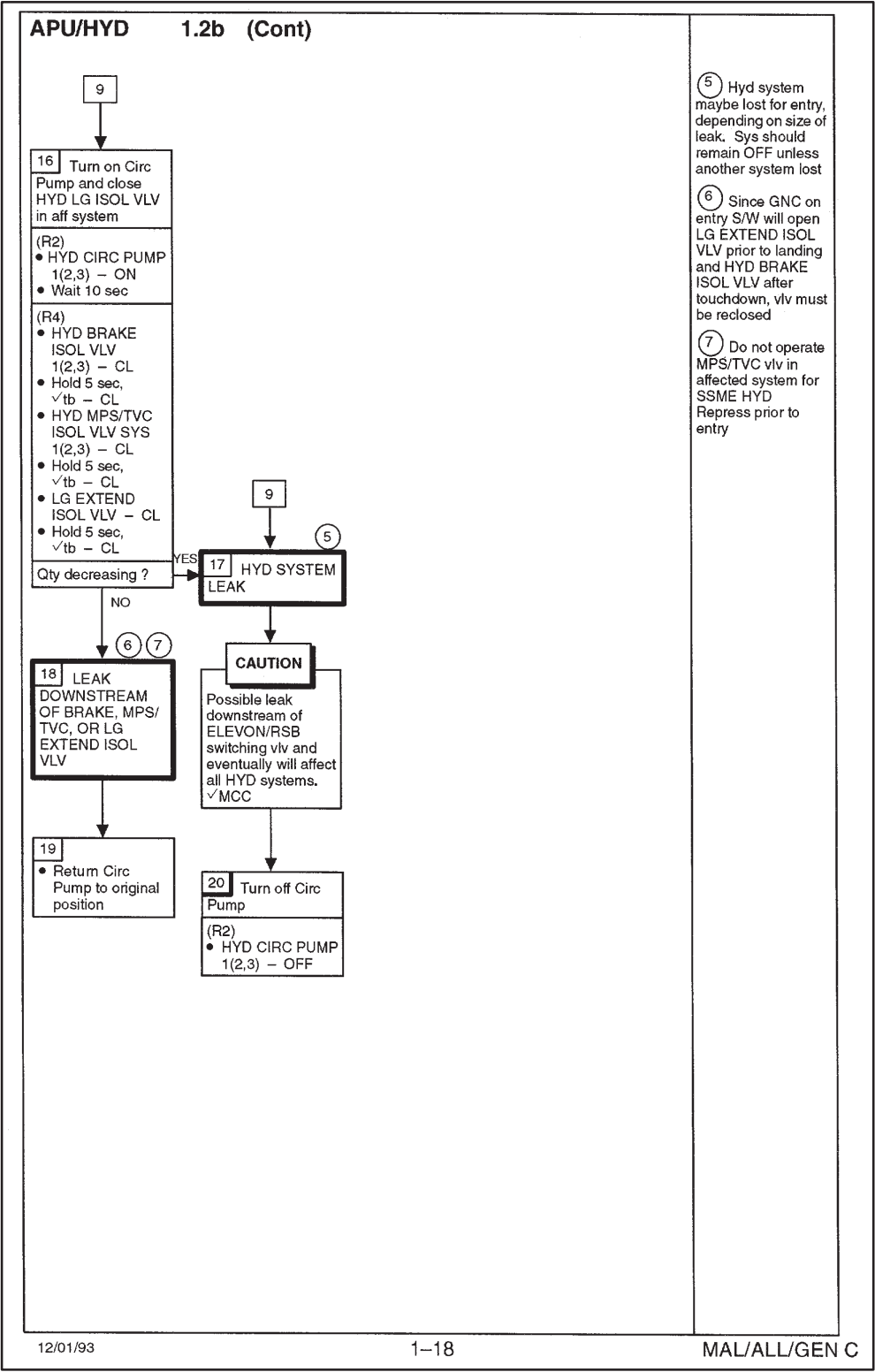


Figure 5-5.- Continuation page of long-form malfunction procedure.

## APU/HYD SSR-1 CIRC PUMP PRESS XDCR FAILURE WORKAROUND

To inhibit FDA alarm for affected Circ Pump

1. For Hyd Circ Pump 1 Press Xdcr failure:

SM 60 SM TABLE MAINT

ITEM 1 +0 5 8 0 1 3 7 EXEC

If Xdcr failed '↓' (low), or DSC LOSS (L), or OI MDM failed (M), ITEM 2 -1 EXEC

If Xdcr failed '↑' (high), ITEM 5 +8 0 1 EXEC

2. For Hyd Circ Pump 2 Press Xdcr failure:

SM 60 SM TABLE MAINT

ITEM 1 +0 5 8 0 2 3 7 EXEC

If Xdcr failed '↓' (low), or DSC LOSS (L), or OI MDM failed (M), ITEM 2 -1 EXEC

If Xdcr failed '↑' (high), ITEM 5 +8 0 1 EXEC

3. For Hyd Circ Pump 3 Press Xdcr failure:

SM 60 SM TABLE MAINT

ITEM 1 +0 5 8 0 3 3 7 EXEC

If Xdcr failed '↓' (low), or DSC LOSS (L), or OI MDM failed (M), ITEM 2 -1 EXEC

If Xdcr failed '↑' (high), ITEM 5 +8 0 1 EXEC

## APU/HYD SSR-2 SIMULTANEOUS CIRC PUMP ON/GPC OPS

To allow normal GPC ops of other two Circ Pumps after failure of X Circ Pump Press Xdcr or manual ON ops of X Circ Pump

1. For Circ Pump 1, Press Xdcr failure or manual ON ops:

SM 60 SM TABLE MAINT

ITEM 16 +0 9 2 1 7 4 2 EXEC

ITEM 17 +8 0 0 EXEC

2. For Circ Pump 2, Press Xdcr failure or manual ON ops:

SM 60 SM TABLE MAINT

ITEM 16 +0 9 2 1 8 4 2 EXEC

ITEM 17 +8 0 0 EXEC

3. For Circ Pump 3, Press Xdcr failure or manual ON ops:

SM 60 SM TABLE MAINT

ITEM 16 +0 9 2 1 9 4 2 EXEC

ITEM 17 +8 0 0 EXEC

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MAL/ALL/GEN C

(a) Regular SSR.

Figure 5-6.- Examples of SSRs.

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| EPS SSR-48<br>BUS LOSS: MNB ML86B                                                                                                |                                                                       |                                                                                                                        |                                         |
|----------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-----------------------------------------|
| ACTIONS                                                                                                                          | EQUIP/FUNCTION LOST                                                   | CREW INDICATIONS                                                                                                       | NOTES                                   |
| (ML86B:A)<br>• cb MNA H2O LINE HTR<br>A – cl                                                                                     | H2O Line Htr B:<br>Waste Dump Line<br>Sply Dump Line<br>Vac Vent Line | (R12L)<br>SPLY H2O<br>DUMP ISOL VLV tb – bp<br>TKB INLET tb – bp<br>TKC OUTLET tb – bp<br>B SPLY ISOL VLV tb – bp      | ① Vlv holds position<br>② Htr A remains |
| (ML86B:D)<br>cb MNA MMU<br>• PORT, STBD HTR<br>A (two) – cl                                                                      | 2 MMU Port, Stbd Htr B                                                | (R13L)<br>MMU GN2 SPLY ISOL VLV<br>B tb – bp                                                                           |                                         |
| (ML31C)<br>• VAC VENT ISOL VLV<br>BUS SEL – MNA                                                                                  | Vac Vent Isol Vlv MNB Cntl                                            | (ML31C)<br>WASTE H2O TK1 DRAIN<br>VLV tb – bp<br>SPLY H2O TKD INLET<br>tb – bp                                         |                                         |
| (WCS)<br>• FAN SEP – 1<br>• HOSE BLOCK – SEP 1                                                                                   | WCS Sep Fan 2 Mtr Relay                                               | (LIGHTS LOST)<br>Middeck Floodlts 2,8<br>Bunk Floodlts 2/4<br>PHS Floodlt<br>Airrk Floodlt 3<br>TA Floodlt 3 (SL only) |                                         |
| (EDO WCS)<br>• WCS PWR SEL – AUTO<br>1, OFF 2                                                                                    | Controller MNB pwr<br>WCS Compactor MNB Cntl                          |                                                                                                                        |                                         |
| (CDR's SEAT)<br>• CDR SEAT PWR BUS<br>SEL – AC3 (dn)                                                                             | CDR Seat Adj via AC2 pwr                                              |                                                                                                                        |                                         |
| (PLT's SEAT)<br>• PLT SEAT PWR BUS<br>SEL – AC3 (dn)                                                                             | PLT Seat Adj via AC2 pwr                                              |                                                                                                                        |                                         |
| If Supply H2O Dump reqd<br>and dump ISOL VLV is<br>failed closed:<br>• Perform SUPPLY WATER<br>DUMP USING FES (ORB<br>OPS, ECLS) | 1 Sply H2O Dump Isol Vlv Cntl                                         |                                                                                                                        |                                         |
|                                                                                                                                  | CO2 Rmvl Sys:<br>Filter dP<br>Vacuum Press<br>PPCO2 Snr<br>Inlet Temp |                                                                                                                        |                                         |
| (Continued)                                                                                                                      | (Continued)                                                           |                                                                                                                        |                                         |

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MAL/ALL/GEN C

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(b) Bus loss SSR.  
Figure 5-6.– Concluded.

| APU/HYD                                                                                                   |                                                                                                                                                                                                                                                                                                              |               |
|-----------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| BFS FSM INDEX .....                                                                                       |                                                                                                                                                                                                                                                                                                              | 1-2           |
| 1.1                                                                                                       | APU                                                                                                                                                                                                                                                                                                          |               |
| 1.1                                                                                                       | APU/HYD SCHEMATIC .....                                                                                                                                                                                                                                                                                      | 1-3           |
| 1.1a                                                                                                      | 'S88 APU TANK T 1(2,3)'<br>'S88 APU FU LN 1(2,3)'<br>'S88 APU FU PMP 1(2,3)' - APU FUEL T .....                                                                                                                                                                                                              | 1-5           |
| 1.1b                                                                                                      | 'S86 APU FUEL 1(2,3)' - APU FUEL QTY ↓,<br>APU FUEL TK P ↑↓ .....                                                                                                                                                                                                                                            | 1-6           |
| 1.1c                                                                                                      | 'S86 APU GBX T 1(2,3)'<br>'S86 APU TEMP 1(2,3)' - APU OIL OUT T ↑↓,<br>APU OIL T ↑↓ .....                                                                                                                                                                                                                    | 1-7           |
| 1.1d                                                                                                      | 'S86 APU GBX P 1(2,3)' - GBX P ↓ .....                                                                                                                                                                                                                                                                       | 1-8           |
| 1.1e                                                                                                      | 'S88 APU TANK T 1(2,3)'<br>'S88 APU FU LN 1(2,3)'<br>'S88 APU FU PMP 1(2,3)'<br>'S88 APU H2O T 1(2,3)' - TK SURF T ↓, TK HTR T ↑↓,<br>FEED LN T ↑↓, PUMP IN T ↑↓,<br>PUMP OUT T ↑↓, PUMP BYP<br>LN T ↑↓, GGVM SUPPLY<br>LN T ↑↓, H2O LN INJ T ↑↓,<br>FU TEST LN T1(T2) ↑↓, FU<br>PUMP DRN LN T1(T2) ↑↓ ..... | 1-9           |
| 1.1f                                                                                                      | RESERVED .....                                                                                                                                                                                                                                                                                               | not used      |
| 1.1g                                                                                                      | 'S86 GG/FU PMP 1(2,3)' - GG BED T ↑↓,<br>INJ T ↓ (BFS ONLY) .....                                                                                                                                                                                                                                            | 1-11          |
| 1.1h                                                                                                      | RESERVED .....                                                                                                                                                                                                                                                                                               | not used      |
| 1.1i                                                                                                      | 'S86 FU TK VLV 1(2,3)' - FUEL TK VLV T ↑↓ .....                                                                                                                                                                                                                                                              | 1-12          |
| 1.2                                                                                                       | HYD                                                                                                                                                                                                                                                                                                          |               |
| 1.2a                                                                                                      | 'S86 RSVR/ACC P 1(2,3)' - HYD ACCUM (RSVR) P<br>LOW (CIL) .....                                                                                                                                                                                                                                              | 1-14          |
| 1.2b                                                                                                      | (see Note A) - RSVR P ↓, ACCUM P ↓ .....                                                                                                                                                                                                                                                                     | 1-15          |
| 1.2c                                                                                                      | 'S86 HYD RSVR Q 1(2,3)' - HYD RSVR QTY ↑↓ .....                                                                                                                                                                                                                                                              | 1-17          |
| 1.2d                                                                                                      | 'S86 HYD RSVR T 1(2,3)' - T ↑↓ .....                                                                                                                                                                                                                                                                         | 1-19          |
| 1.2e                                                                                                      | 'S86 WSB P 1(2,3)'<br>'S86 WSB QTY 1(2,3)' - WSB N2 P ↓, WSB H2O QTY ↓,<br>WSB REG P ↓↑ .....                                                                                                                                                                                                                | 1-20          |
| 1.2f                                                                                                      | 'S86 WSB T 1(2,3)' - WSB BLR T ↑↓ .....                                                                                                                                                                                                                                                                      | 1-21          |
| 1.2g                                                                                                      | 'S86 WSB T 1(2,3)' - TK T ↓ .....                                                                                                                                                                                                                                                                            | 1-22          |
| 1.3                                                                                                       | THERMAL HYD                                                                                                                                                                                                                                                                                                  |               |
| 1.3a                                                                                                      | 'S87 CIRC PMP 1(2,3)' - HYD CIRC PUMP PRESS LOW ..                                                                                                                                                                                                                                                           | 1-24          |
| 1.3b                                                                                                      | (see Note A) P ↓ .....                                                                                                                                                                                                                                                                                       | 1-25          |
| 1.3c                                                                                                      | 'S87 CIRC PMP 1(2,3)' - P ↑ .....                                                                                                                                                                                                                                                                            | 1-27          |
| 1.3d                                                                                                      | 'CIRC PUMP' - CIRC PUMP .....                                                                                                                                                                                                                                                                                | 1-28          |
| 1.3e                                                                                                      | 'S87 THERMAL HYD' - HYD HX OUT T ↓ .....                                                                                                                                                                                                                                                                     | 1-29          |
| 1.3f                                                                                                      | 'S87 THERM CNTL 1(2,3)' - LINE TEMPS: ELEVON, RD/SB,<br>BDY FLP ↑↓ .....                                                                                                                                                                                                                                     | 1-30          |
| NOTE A                                                                                                    |                                                                                                                                                                                                                                                                                                              |               |
| The identified MAL represents a support procedure that is entered from other<br>procedures or on MCC call |                                                                                                                                                                                                                                                                                                              |               |
| 1-1                                                                                                       |                                                                                                                                                                                                                                                                                                              | MAL/ALL/GEN C |

**Figure 5-7.— Section table of contents for Malfunction Procedures book showing serial numbering, CIL, major tab, and highlight boxes for super mals.**

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## 5.4 REFERENCE DOCUMENTS

### 5.4.1 C/W and FDA Limits Tables

C/W and fault detection annunciation (FDA) limits are provided in table form.

The following format will be used as the basis for specifying C/W and FDA limit information changes in the reference data books and other similar references:

| PARAMETER NAME | C/W CH | H/W C/W     |             | ENA/ INH | PARA ID | SM ALERT |    | B/U C/W |       | PRECONDITION (P) AND/OR BILEVEL STATE (BL) |
|----------------|--------|-------------|-------------|----------|---------|----------|----|---------|-------|--------------------------------------------|
|                |        | LO V(LO EU) | HI V(HI EU) |          |         | LOW      | HI | LO EU   | HI EU |                                            |
|                |        |             |             |          |         |          |    |         |       |                                            |

The following ground rules will be applicable:

- Use only the columns for which changes have occurred. This includes only the HIGH or LOW columns for H/W C/W, B/U C/W, and SM ALERT
- The parameter name will always be presented as given in the C/W and FDA Table in the Reference Data book, but no footnotes are shown
- Engineering units will be shown in parentheses
- If several changes that fit under different categories are done together, the minimum format that satisfies all of the above ground rules will be presented, and columns that are not applicable for a particular parameter will be left blank

An example of combined changes with the minimum columns required:

| PARAMETER NAME  | C/W CH | H/W C/W     |             | ENA/INH | PARA ID | SM ALERT LOW |
|-----------------|--------|-------------|-------------|---------|---------|--------------|
|                 |        | LO V(LO EU) | HI V(HI EU) |         |         |              |
| CAB P           | 4      | 100(4.00)   |             | INH     | 0612642 | 1.45         |
| O2 FLOW 1       | 14     |             |             |         |         |              |
| AV BAY FAN ΔP 1 |        |             | 2.50        |         |         |              |
| GPC 1           | 5      |             |             |         |         |              |

Note that extraneous data (such as software (S/W) IDs when only a hardware (H/W) parameter is to be changed) should be suppressed since this could lead to confusion.

### 5.4.2 DPS/CDMS Display Diagrams

In the DPS/CDMS Dictionary and similar books, the use of color on CRT displays will be indicated as shown in figure 5-8. Otherwise, CRT display diagrams will look as much like the actual displays as possible.



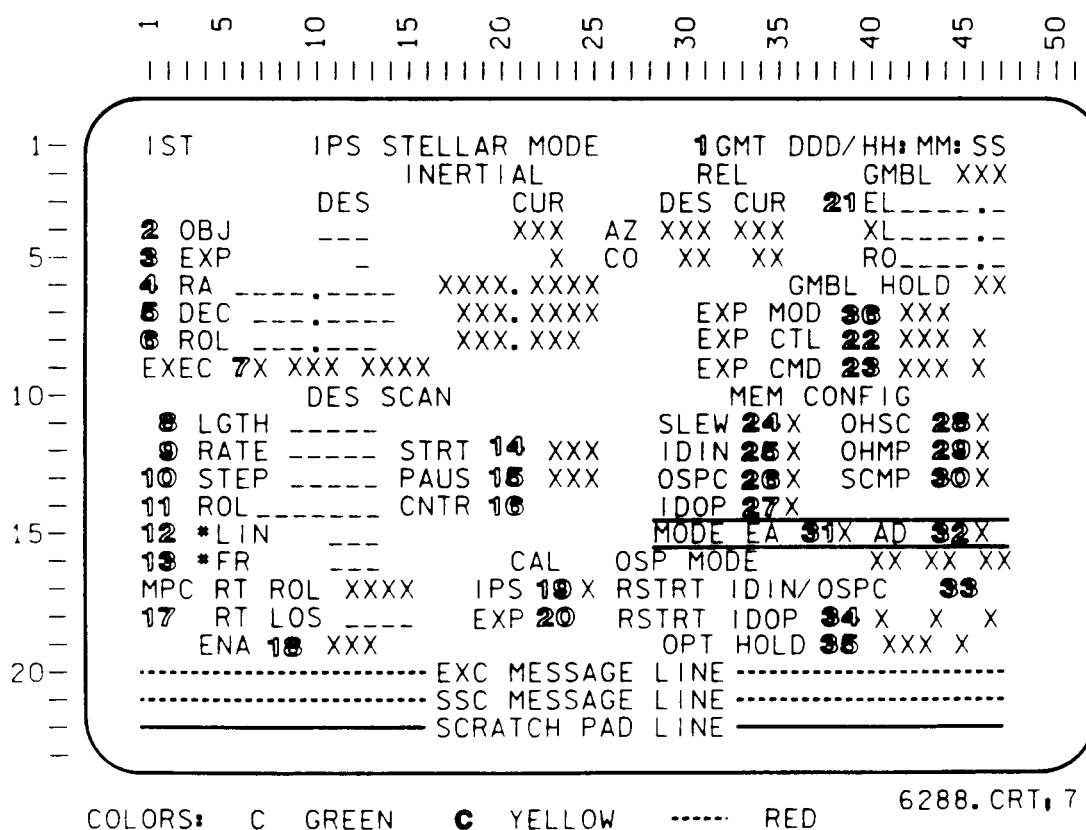


Figure 5-8. Color indications in CRT display diagram.

## 5.5 CUE CARDS

The need for cue cards in various locations of the shuttle is dictated by the complexity and criticality of crew procedures. Location and accessibility are major constraints on cue card size and shape, thus requiring unique FDF standards.

### 5.5.1 Cue Card Pagination, Page Code, and Card Code

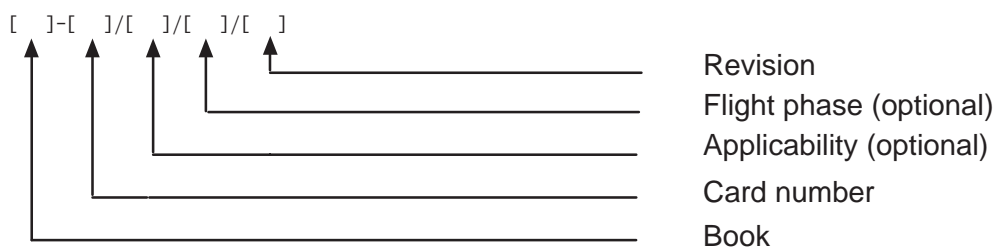
Cue card pages will use the normal page numbering of the book in which they appear with a prefixed "CC" (e.g., CC 10-17; see section 2.2.5). On the configuration section pages, the notation "FAB USE ONLY" will appear at the far left of the bottom of the page. Page codes will follow the same standards as the rest of the book. See section 2.2.5 and figure 5-9.

Cue cards are treated as separately controlled graphics. The same version of a cue card may appear in more than one place within the controlling document. Cue cards thus have card codes that actually appear on the card as flown. The card codes are used to provide a separate tracking code. These card codes will contain the following identifiers:

- Book – Abbreviation given in CPMP Appendix A
- Card number – A sequential card number followed by a letter designation for each face. The "a" will indicate the front of a card and the "b" will indicate the back of a card. For cards with more than two faces (e.g., hinged cards or the OMS/RCS slide rule and inserts),

additional letters will be used for each printed surface (e.g., a, b, c, d or a, aa, b, bb). Overlays and fabricated transparencies have only one face and will use an “a” card number designator (see figure 5-12). Cue cards with duplicate front and back faces will use an “a,b” card-number designator on both faces (e.g., multiple fill-in forms). To avoid confusion on flight manifest records, the card numbers in flight supplement books will not duplicate the card numbers in related generic books. However, the card numbers used in a flight supplement will be reused for succeeding flight supplements if these numbers do not conflict with those used in the corresponding generic document. For example, the generic card numbers PDRS-1, PDRS-2, PDRS-3 will not be used in a flight supplement if these same numbers appear on the generic PDRS cue cards

- **Applicability** – Optional, for use in flight supplements or other nongeneric applications (e.g., “IUS” for inertial upper stage flights). A flight number will be used for a cue card in flight supplements to prevent duplicating card codes used in similar flight supplements, but for different flights
- **Flight phase identifier** – Optional (i.e., “A” for ascent, “O” for on-orbit, “D” for deorbit, and “E” for entry)
- **Revision** – A, B, C, etc., for the first, second, third, etc., revision since the adoption of a card code. New and changed cue card masters shall require a new revision letter, regardless of the reason for a new cue card print master. The cue card code will remain unchanged if no actual changes are made to the format, size, or text of the cue card. Likewise, the revision code will remain unchanged as the book progresses through various milestones and PCNs if no actual changes are made to the cue card



An example of a card code is as follows:

ASC-2a/67/A/B – The front of card 2 in the Ascent Checklist/STS-67 flight specific/card is applicable to the ascent flight phase/second card version since card codes were adopted.

The card code should appear at the lower-right corner of a card but may appear elsewhere if space is limited. The code may be placed sideways, if necessary, to appear distinct from the actual data on the card. See figure 5-9. When a dual-faced cue card receives a change to one face only (e.g., back only), the unchanged side or face should not be reprinted.

Pages in the DAP Book (published in the FLIGHT PLAN) and overlays will also be given card codes to uniquely identify them and assist in production and fabrication.

### 5.5.2 Cue Card/Vehicle Coordination

The vehicle/cue card interface is established by patches of hook Velcro on the cue card and patches of pile Velcro on the vehicle. This interface is documented in the Cue Cards and Procedural Decals book. The interface and the resolution of problems relative to card and

Velcro size and shape are the responsibility of the Cue Cards and Procedural Decals book manager.

All cue cards and cue card changes including crop marks and Velcro positioning shall be coordinated with the Cue Cards and Procedural Decals book manager. Cue cards shall comply with regular prep standards to the extent possible. Any deviations shall be coordinated with the FDF Manager and the Astronaut Office FDF representative.

Cue cards are divided into the following two groups:

- Cue cards that fly in specific locations and have critical size, shape, or Velcro requirements (fig. 5–9). For this group, the specific requirements of each cue card shall be coordinated with the Cue Card and Procedural Decals book manager. This group includes all cue cards published in the Ascent Checklist, Entry Checklist, and Ascent/Entry Systems Procedures
- Cue cards that do not fly in specific locations and are affected only by stowage and fabrication constraints. For this group, the maximum cue card size is 8–1/2 by 10–1/2 inches; these cue cards shall be coordinated (for fabrication and stowage) with the Cue Card and Procedural Decals book manager

### 5.5.3 Cue Card Logistics

Logistics is the second major concern. Approximately 100 cue cards must be fabricated and stowed in terms of current content, size, shape, and Velcro requirements. For a given flight manifest, the current cue card configuration and content are given in one of the following forms (controlling documents):

- Cue cards contained in particular FDF books are designed as part of that book. See figure 5–10. Cue card content and configuration will be published in the cue card section of each FDF book (and/or applicable flight-specific Flight Supplement). See section 2.1.6 for cue card treatment in the LOEP
- Current versions and configurations of cue cards not printed in specific FDF books are compiled and printed in the Cue Card and Procedural Decals book (generic edition)

These controlling documents also provide ground controllers with exact copies of the content and configuration of all in-flight cue cards.

### 5.5.4 Cue Card Configuration

The following “configuration elements” are illustrated in figures 5–9 and 5–10.

- Each cue card shall have crop marks or outlines to define its size and shape for fabrication. The correct crop marks (“+”, “L”, or “J”) will be used to assure appropriate trimming (see figures). The “+” indicates a full trim along two planes (i.e., an outside corner). The “J” indicates a trim to the point of intersection (e.g., an inside corner, see figure 5–10). A dotted line (.....) will be used to indicate nonvertical or nonhorizontal cut edges. Also, areas to be cut out will be cross-hatched and the words “CUT OUT” will be added over the cross-hatching. See figure 5–9
- Many cue cards will have a title (abbreviated as appropriate to conserve space) in 12-point Helvetica, positioned within the crop marks as part of the printed cue card

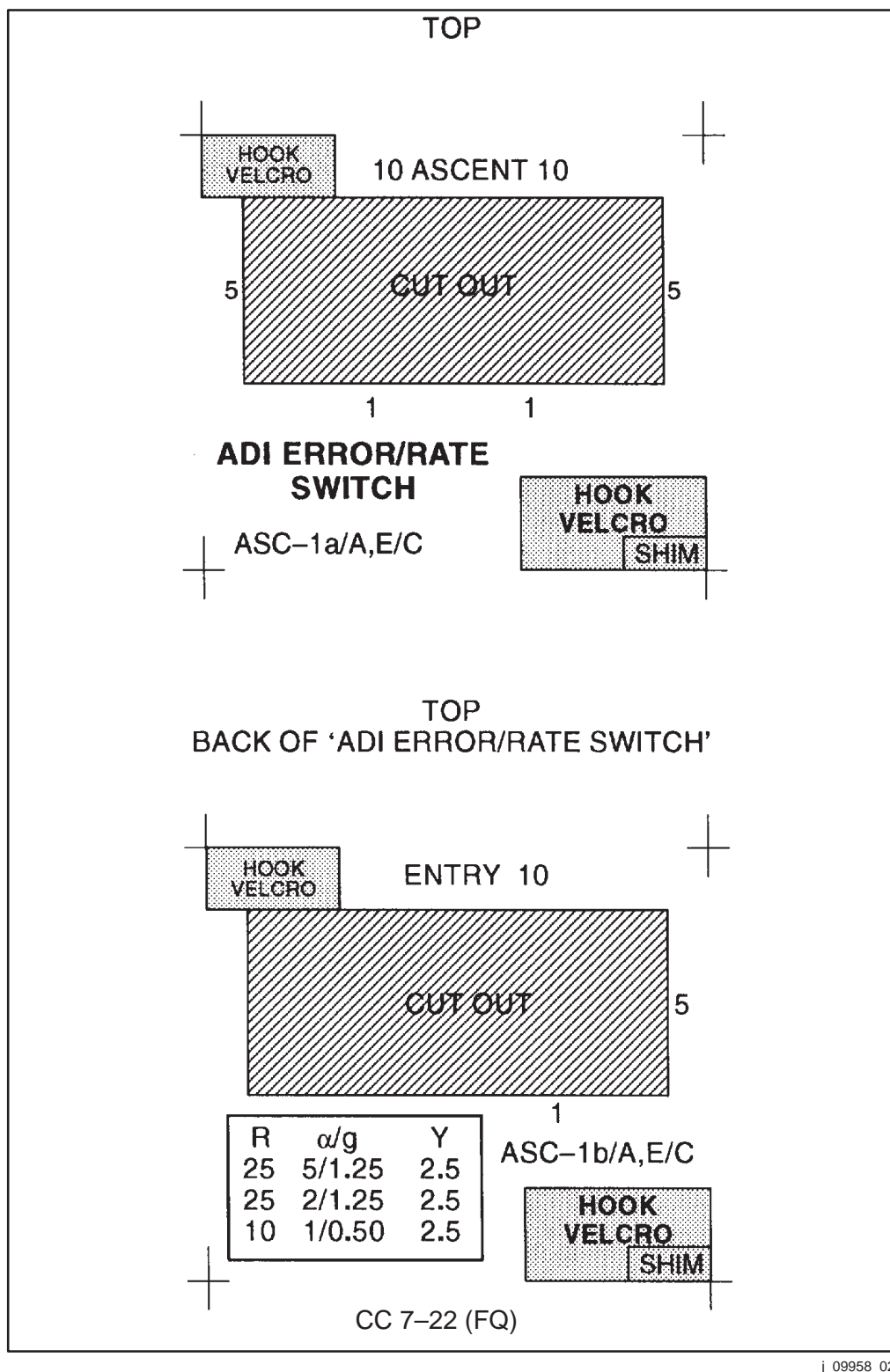
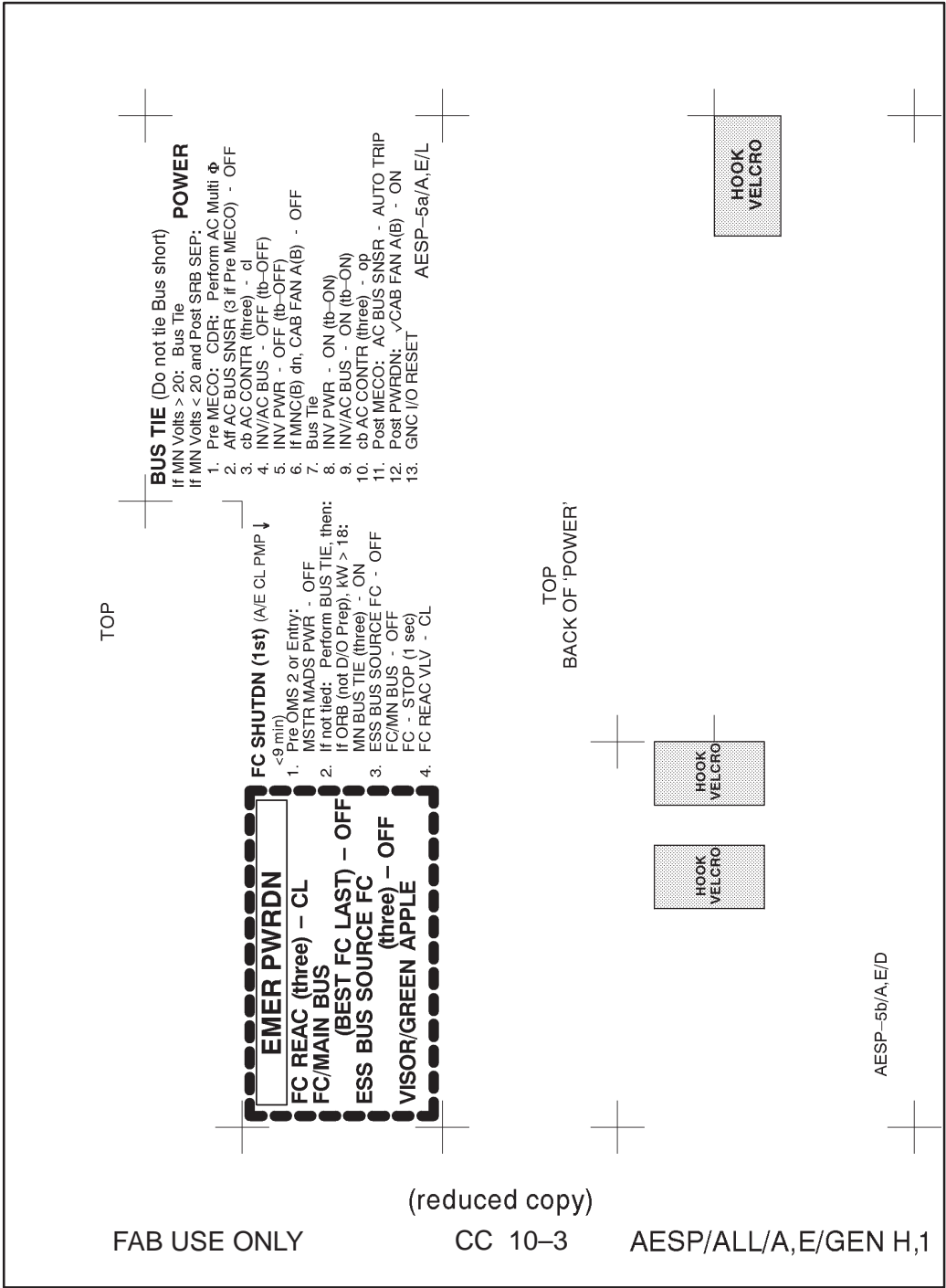


Figure 5-9.— Example of a cue card master prepared for specific location.



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Figure 5-10.- Example of a reduced cue card configuration page.

- Fabrication notes and instructions shall be placed outside the crop marks or outline (i.e., outside the image area). As illustrated, fabrication instructions shall include (as a minimum) the following: (1) labeling the TOP on both the front and back of each cue card and (2) labeling the back of each cue card with the TITLE associated with the front. See figures 5-9 and 5-10
- All cue cards have a “front” and “back.” Each side is printed and trimmed separately, then fabricated into a layup of the correct size, shape, and Velcro configuration. Crop marks for front and back must enclose identical image areas (i.e., front and back must match). If the front and back of a card are in different books (such as in a generic book and its flight supplement), there will be a note outside the crop marks indicating this. For example:

“Front of this card is in ORB OPS FS”

- When the front and back of a card are in different books, the cue card code will be a special two-line designator. (This standard does not apply to flight supplements which may have a front in the generic and the back in the flight supplement, or vice versa.) In the controlling document for a particular face (i.e., “a” or “b”), the cue card will use a normal code. However, immediately below the code, a parenthetical notation will identify the phantom location for the same face, as if the card existed in the alternate book. The front and back shall carry the same card number. For example, if the front of Card 7 (flight phases A, O, E for Revision A) appears in the Ascent/Entry Systems Procedures book and the back of Card 7 appears in the Orbit Pocket Checklist, the cue card codes will be configured and printed on the cue card masters as follows:

For a cue card in the Ascent/Entry Systems Procedures:

AESP-7a/A,O,E/A  
(OPCL-7a)

For a cue card in the Orbit Pocket Checklist:

OPCL-7b/A,O,E/A  
(AESP-7b)

- Generally, cue cards will have patches of hook Velcro to interface with patches of pile Velcro. However, a few cue cards are designed without Velcro patches. Cue cards designed for special locations shall have specific hook/pile interface coordination (section 5.5.2, step 1). Change bars shall be added as required, but placed outside the cue card crop marks
- Some cue cards have procedures on one side (single sided); some have procedures on both sides (dual sided). Single-sided cue cards shall have Velcro on the back; dual-sided, both front and back
- Cue cards may need to be reduced for inclusion in the parent document. In this case, the reduced cue card copy will bear the notation “(reduced copy),” which is printed outside the crop marks of the cue card in all lowercase letters and in parentheses. The cue card will be differentiated from the page copy by the designation “(FQ)” added after the page number on the actual cue card only
- The page in an FDF book on which a cue card is printed will be formatted and paginated the same as any other page with graphics

## 5.6 FLIP BOOK FORMAT

In a zero-g environment, checklists must be hand-held, tethered, or restrained in stowage. The flip book (FB) evolved to fill the need for a small checklist that a crewmember could affix to the shuttle interior, flip the pages as necessary, and have both hands free for performing crew activities.

The FB is a hybrid checklist/cue-card document. The book is unique in that it has no front or back cover. It is paginated serially, but its page content and tab labels are arranged from front-to-back or from back-to-front. The five FDF FBs are the Commander and Pilot Ascent FBs (in the Ascent Checklist as controlling document), the Pilot and Commander Window FBs and Pilot Overhead FB (all three in the Ascent/Entry Systems Procedures as controlling document). See figure 5-11.

FBs shall have the following “configuration elements”:

- FBs use the small book format with a row of small major tabs. Image areas for the tabs and the text are illustrated in figure 2-10. Change bars will be placed inside the crop marks except for the Ascent/Entry book pages
- Each procedural page in an FB normally is tabbed. Crewmembers readily locate the book contents by glancing at tab titles which are printed in 10-point Helvetica bold for emphasis
- Tab titles will reference the material on the pages hidden by the tab page (i.e., tab labels reference procedures on the two pages seen when the tab page is flipped)
- Pagination and page notes shall follow FDF standards (section 2.2.4). Page numbers will have the prefix “FB” (e.g., FB 10-12)
- The Pilot and Commander Window FBs and Pilot Overhead FB are separated into two divisions: Powered Flight (A) and Glided Flight (E). For the flight books, the Powered Flight section and the Glided Flight section for each flip book is separated by a strip, fabricated as part of the FB backboard
- For the Ascent FBs, tab lines of type will run parallel to the long edge of the paper. For the Pilot Overhead FB and the Commander and Pilot Window FBs, tab lines of type will run parallel to the text. See figure 5-11
- FB pages will be held in position by patches of Velcro positioned in top corners of the pages (hook Velcro in top right-hand corners of odd-numbered pages, pile Velcro in top left-hand corners of even-numbered pages; see figure 5-11)
- As per cue card standards, the locations of Velcro patches shall be designated for proper interface. Crop marks will designate the trim lines for both front and back printing. Holes are punched within a 1/2-inch binding area. Fabrication instructions and notes shall be positioned just outside the crop marks

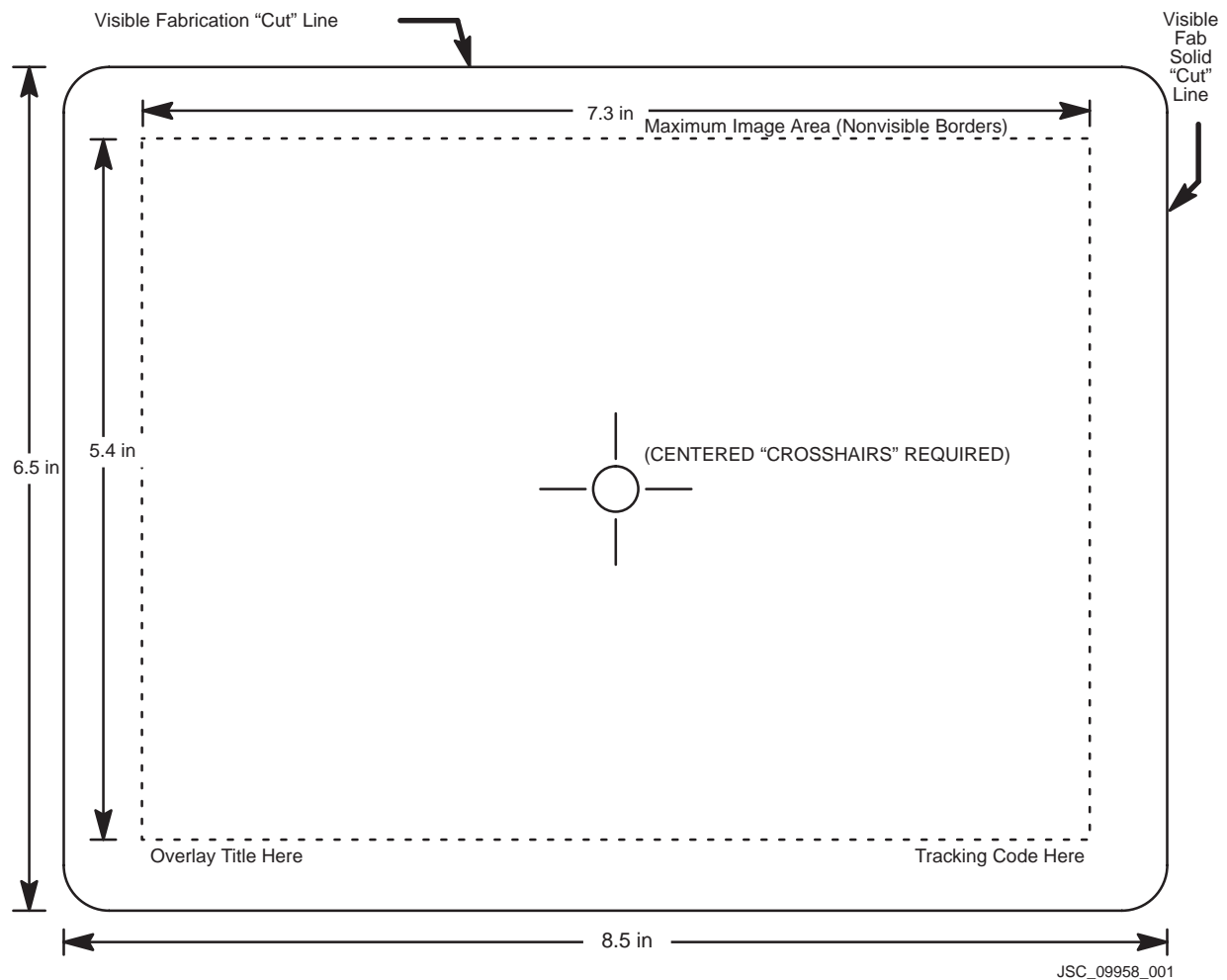


IL 6



## 5.7 CCTV OVERLAYS

Occasionally, overlays are required for the CCTV monitors. These fabricated items are handled the same as cue cards. The standard page code, as described in section 2.2.5, is placed at the bottom of the page outside the image area. A separate tracking code is also used and actually appears on the overlay. Tracking code identifiers are the same as for cue cards and are described in section 5.5.1. A note is added above the transparency fabrication “cut” line stating to “Fabricate as a Transparency.” Dimensions and location of the identifiers and title are shown in figure 5–12.



**Figure 5–12.— CCTV overlay template.**

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## APPENDIX A PROOFMARKS

|                    |                               |                     |                              |
|--------------------|-------------------------------|---------------------|------------------------------|
| <i>STET, x x x</i> | Let it stand; disregard marks | <i>g or e</i>       | Delete                       |
| <i>(</i>           | Close up                      | <i>e</i>            | Delete and close up          |
| <i>^</i>           | Caret; insert where indicated | <i>sp</i>           | Spell out or verify spelling |
| <i>^ ^</i>         | Insert comma, hyphen          | <i>o, @</i>         | Insert period, colon         |
| <i>#, 2#</i>       | Leave blank line, two lines   | <i>#, 2#</i>        | Insert space, two spaces     |
| <i>U or L</i>      | Transpose words               | <i>~</i>            | Transpose letters            |
| <i>¶ or P</i>      | New paragraph                 | <i>no ¶ or no P</i> | No paragraph                 |
| <i>≡</i>           | Capitalize                    | <i>/</i>            | Lower case                   |
| <i>≡ e</i>         | Initial letter cap only       | <i>⌋ ⌌</i>          | Center text                  |
| <i>⌋</i>           | Move left to point given      | <i>⌌</i>            | Move right to point given    |
| <i>Ed: ...</i>     | Note to editor                | <i>Auth: ...</i>    | Note to author               |
| <i>s/b</i>         | Should be                     |                     |                              |

*#* SAMPLE PARAGRAPHS *ap #*  
*#* The purpose of these paragraphs is to demonstrate the proofmarks commonly used in preparing FDF and other support mission documentation. *which are*

*no ¶* Use of the above marks although not all inclusive will:

- 1) Provide a common means of communicating *our* intents
- 2) Avoid ambiguity *delete #*

- 3) Shorten *the* time required for proofing and reviewing proofed manuscript

*¶* It is recommended that *these* marks be used to denote proposed changes to published FDF books. The marked page can be submitted as an attachment to Form 482 *o* (Crew *o* PROCEDURES change Request) *o*

### SAMPLE PARAGRAPHS

The purpose of these two paragraphs is to demonstrate the proofmarks which are commonly used in preparing FDF and other mission support documentation. Use of the above marks, although not all-inclusive, will:

- 1) Provide a common means of communicating intent
- 2) Avoid ambiguity
- 3) Shorten time required for proofing and reviewing proofed manuscripts

It is recommended that these marks also be used to denote proposed changes to published FDF books. The marked page can be submitted as an attachment to Form 482 (Crew Procedures Change Request).

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## APPENDIX B

### ABBREVIATIONS USED IN PROCEDURAL NOMENCLATURE\*

|                     |            |              |         |
|---------------------|------------|--------------|---------|
| Acceleration        | ACCEL      | Contingency, |         |
| Acknowledge         | ACK        | Continue     | CONT    |
| Actuator,           |            | Control      | CNTL    |
| Activation          | ACT        | Controller   | CNTRL   |
| Adapter             | ADAPT, ADP | Critical     | CRIT    |
| Advance             | ADV        | Crossover    | XOVR    |
| Airlock             | AIRLK, A/L |              |         |
| Alternate,          |            | Decrease     | DECR    |
| Altitude            | ALT        | Deploy       | DPY     |
| Altimeter           | ALTM       | Develop      | DEV     |
| Antenna             | ANT        | Disable      | DSBL    |
| Ascent              | ASC        | Discharge    | DISCH   |
| Assembly            | ASSY       | Disconnect   | DISCNCT |
| Attitude            | ATT        | Discrete     | DISC    |
| Audio               | AUD        | Disengage    | DISENG  |
| Auxiliary           | AUX        | Display      | DISP    |
| Avionics            | AV         | Down         | DN      |
| Azimuth             | AZ         | Downlink     | DNLK    |
|                     |            | Drive        | DR      |
| Backup              | B/U        |              |         |
| Battery             | BATT       | Electric(al) | ELEC    |
| Body                | BDY        | Elevation    | EL      |
| Boiler              | BLR        | Emergency    | EMER    |
| Bright              | BRT        | Enable       | ENA     |
| Bulkhead            | BKHD       | Error        | ERR     |
| Bypass              | BYP        | Evaporator   | EVAP    |
|                     |            | Execute      | EXEC    |
| Cabin               | CAB        | Experiment   | EXP     |
| Camera              | CAMR       |              |         |
| Caution and Warning | C/W        | Feedline     | FDLN    |
| Center              | CTR        | Flap         | FLP     |
| Channel             | CH         | Flight       | FLT     |
| Charger             | CHGR       | Forward      | FWD     |
| Circuit             | CKT        | Frequency    | FREQ    |
| Circuit Breaker     | cb         | Fuel         | FU      |
| Circulation         | CIRC       | Fuel Cell    | FC      |
| Clear               | CLR        | Function     | FUNC    |
| Close               | CL, cl     |              |         |
| Command             | CMD        | Generate     | GEN     |
| Commander           | CDR        | Gimbal       | GMBL    |
| Communication       | COMM       | Ground       | GND     |
| Conditioner         | COND       |              |         |
| Connect             | CNCT       | Hardline     | HDLN    |
|                     |            | Hardware     | HDW     |

\*When appropriate, an abbreviation listed as all capitals may be used as a lower case or initial cap abbreviation. However, an abbreviation listed only in lower case letters will not be used as an all-capital abbreviation.

|                |              |              |            |
|----------------|--------------|--------------|------------|
| Heater         | HTR          | Operation(s) | OPS        |
| Heat Exchanger | HX           | Operator     | OPR        |
| Helium         | He           | Orbiter      | ORB        |
| High           | HI           | Oscillator   | OSC        |
| Horizontal     | HORIZ        | Outboard     | OUTBD      |
| Humidity       | HUM          | Over         | OVR        |
| Hydraulic      | HYD          | Overhead     | OVHD       |
|                |              | Oxidizer     | OXID       |
|                |              | Oxygen       | O2         |
| Inboard        | INBD         |              |            |
| Increase       | INCR         |              |            |
| Indicator      | ind          | Panel        | PNL        |
| Inhibit        | INH          | Parameter    | PARAM      |
| Initiate       | INIT         | Payload      | PL         |
| Instrument     | INST         | Pedestal     | PED        |
| Interchanger   | INTCHGR, ICH | Pilot        | PLT        |
| Intercom       | ICOM         | Pitch        | P          |
| Interconnect   | I'CNCT       | Playback     | PLBK       |
| Interface      | I/F          | Pneumatics   | PNEU       |
| Intermediate   | INTERM       | Pointing     | PTG        |
| Isolation      | ISOL         | Position     | POSN       |
|                |              | Power        | PWR        |
| Landing        | LDG          | Propellant,  |            |
| Latch          | LAT          | Propulsion   | PROP       |
| Left           | L            | Pressure     | PRESS      |
| Light          | LT, It       | Primary      | PRI        |
| Lighting       | LTG          | Pushbutton   | pb         |
| Line           | LN           |              |            |
| Link           | LK           | Quantity     | QTY        |
| Location       | LOC          |              |            |
| Low            | LO           | Radar        | RDR        |
|                |              | Radiator     | RAD        |
| Main           | MN           | Range        | RNG        |
| Major          | MAJ          | Ready        | RDY        |
| Maneuver       | MNVR         | Reactant(s)  | REAC       |
| Manifold       | MANF         | Receive      | RCV        |
| Manual         | MAN          | Record       | RCD        |
| Master         | MSTR         | Recorder     | RCDR       |
| Maximum        | MAX          | Reference    | REF        |
| Mechanical     | MECH         | Regulator    | REG        |
| Medium         | MED          | Rehydration  | REHYD      |
| Memory         | MEM          | Reject       | REJ        |
| Message        | MSG          | Release      | REL        |
| Mission        | MSN          | Relief       | RLF        |
| Monitor        | MON          | Required     | REQD, reqd |
|                |              | Return       | RTN        |
| Navigation     | NAV          | Right        | R          |
| Night          | NITE         | Roll         | R          |
| Normal         | NORM         | Rotation     | ROT        |
| Nozzle         | NOZ          |              |            |
|                |              | Saturation   | SAT        |
| Open           | OP, op       | Secondary    | SEC        |
| Operate        | OPER         | Select       | SEL        |

|                  |        |
|------------------|--------|
| Sensor           | SNSR   |
| Sequence         | SEQ    |
| Separation       | SEP    |
| Shutdown         | SHUTDN |
| Signal           | SIG    |
| Software         | SW     |
| Spacecraft       | S/C    |
| Speaker          | SPKR   |
| Speedbrake       | SPDBK  |
| Standby          | STBY   |
| Starboard        | STBD   |
| Status           | STAT   |
| Stow, Stowed     | STO    |
| Strength         | STR    |
| Supply           | SPLY   |
| Switch           | sw     |
| System           | SYS    |
|                  |        |
| Table            | TBL    |
| Talkback         | tb     |
| Tank             | TK     |
| Telemetry        | TLM    |
| Temperature      | TEMP   |
| Terminate        | TERM   |
| Thumbwheel       | TW, tw |
| Transducer       | XDCE   |
| Transfer         | XFER   |
| Transmit         | XMIT   |
| Transmit/Receive | T/R    |
| Tranceiver       | XCVR   |
| Tunnel           | TNL    |
|                  |        |
| Umbilical        | UMB    |
| Uplink           | UPLK   |
| Utility          | UTIL   |
|                  |        |
| Vacuum           | VAC    |
| Valve            | VLV    |
| Variable         | VAR    |
| Velocity         | VEL    |
|                  |        |
| Vernier          | VERN   |
| Voltage          | VOLT   |
| Volume           | VOL    |
|                  |        |
| Water            | H2O    |
|                  |        |
| Yaw              | Y      |

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